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AMERICAN DENTAL ASSOCIATION

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Ludwig's Angina—*Doherty*

Cavity Preparation—*Bodecker*

Repair of Facial Defects—*Bulbulian*

Intra-Oral Carcinoma—*Hollander et al.*

Pulpless Teeth—*Lundquist and Kellogg*

Temporomandibular Joint—*Russell and Bayles*

Prosthetic Dentistry in Navy—*Grunewald*

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A RATIONAL TECHNIC FOR AMALGAM RESTORATIONS

By K. Paul Ramsay, D.D.S., L.D.S., R.C.S., Kansas City, Mo.

AMALGAM restorations have interested me since the earliest days of my practice because I have had more failures with this material than with any other. Because I have practiced primarily upon English people, I have had to use amalgam to a much greater extent than I should have done had my practice been in a similar class on this side of the ocean. The average Englishman has an aversion to the use of gold in his mouth. Because I have seen amalgam restorations which were inserted as long ago as 1896 (when the records of my practice were begun) and which were still in good condition, I knew that they could be employed with complete satisfaction.

Some of these restorations were made ten years before the casting process came into use in dentistry. The fillings were inserted in teeth which it was practically impossible to restore with foil and in situations in which, unless a crown was used, amalgam was the only means of rebuilding the tooth and making it a useful member of the dental mechanism.

When one has the good fortune to observe such work, one is forced to the conclusion that most failures with amalgam are one's own fault and are due to a lack of ability and knowledge in utilizing the peculiar characteristics of the material rather than to the material itself.

I probably would have given up because of my failures had I not been forced to continue because of the peculiar character of practice in London and had I not concluded that if my predecessors could produce really wonderful restorations, there was no reason why I should not be able to do so.

Whenever I observed one of my many failures, I tried to analyze the reason and often sought an explanation from older and wiser dentists. The result is a technic which is culled from many sources. I claim no originality for any of the principles embodied herein and my only excuse for appearing before you

Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 10, 1940.

is that, while practicing abroad, I have seen some good work that came out of American offices, but most of the amalgam work left much to be desired. I thought that my experiences might prove useful to some of you who may be having the same difficulties that I have met many times over.

I attended dental school in the early twenties. I then had the good fortune to be an assistant in a "gold and porcelain practice" in Philadelphia, before going to London. Consequently, I had experience with foil, inlays, etc., but almost none with amalgam. When I told my late predecessor that amalgam was regarded more or less as a temporary filling material (which it was in those halcyon days), his reply was that, in his practice, amalgam was a permanent material and that I should regard it as such and treat it with the respect which it merited. Since 1928, when the American Dental Association in conjunction with the United States Bureau of Standards took steps to promote minimum standardized requirements for this material, and since the first depression of 1929, when there was a decided reduction in the ability of patients to pay for the more expensive gold and porcelain work, amalgam has had a greatly deserved revival.

I shall begin with the premise that our first duty is to render the best service possible under conditions existing at the time of operation. I may best illustrate this premise and its relation to this paper by a true incident. A short time after my return to the States, I saw a dentist friend, who asked me if I remembered a woman to whom he had given my name in case she had need for dental care while in England. The hard rolls did their worst and one of her lower third molars collapsed under the strain. She was leaving London that morning and would not be seeing her dentist for at least three months, meanwhile traveling around Europe where, in some localities, it would be difficult to obtain dental attention. Besides, who wants to spoil a trip with continual visits to the den-

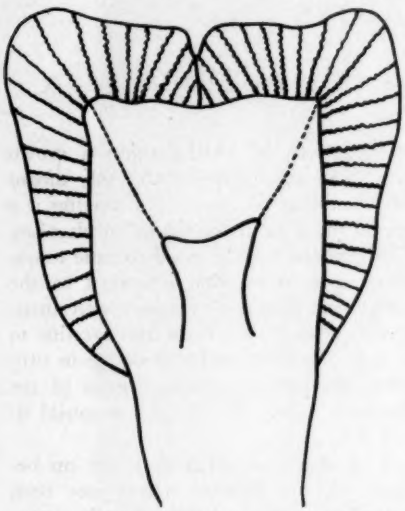

Fig. 1.—Diagrammatic illustration showing direction of enamel rods.

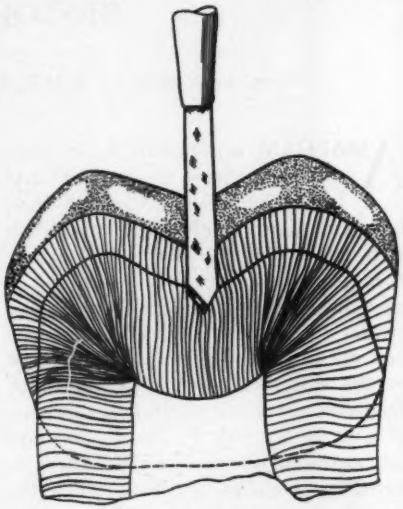

Fig. 2.—Penetration of enamel with bibeveled drill; used where caries has not undermined area which can be readily opened with chisels.

tist? As the bulk of the crown and old fillings were gone, gutta-percha would not have remained five minutes, cement would have cracked away and gold was impossible in the time available. Therefore, the tooth was built up with a soft cement lining and an amalgam restoration and the patient was told to see her dentist immediately on her return home. That amalgam filling had been in three years when he spoke to me about it, and as it was giving excellent service, it was left *in situ*. What other material would have rendered such adequate service and proved as useful under the circumstances?

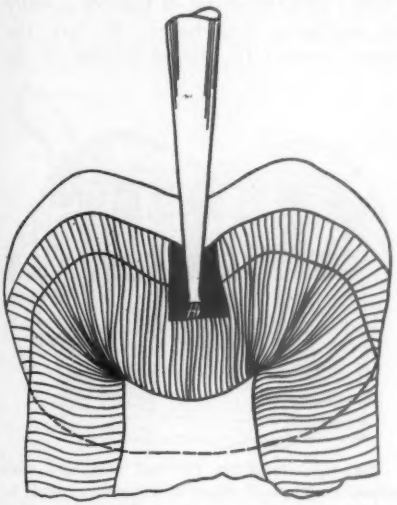

Fig. 3.—Undermining enamel with inverted cone bur—to be followed with chisels.

I am not going into the details of where and when to use amalgam, as I assume such basically simple facts to be known by all. Naturally, one must employ discretion and judgment in the use of the material and not place it where it is definitely contra-indicated, as in overlapping a thin weak cusp to protect the latter or in anterior teeth.

Likewise, I am not going into the metallurgic aspect of alloys and amalgams. That side of the subject has been treated by renowned metallurgists and its details would be sheer redundancy on my part. Information on this phase of amalgam work can be found in various publications by Paffenbarger, Taylor and others.

I state at the outset that it is infinitely preferable to work under the rubber dam, although it is not always essential or possible. I fully realize that the use of the word "possible" is fraught with danger, but the longer I practice, the less credence I place in the statement of the man who says that he can always do a certain thing in dentistry. Either he lacks experience and has a limited practice with all the time desirable or, in accomplishing his aim, he does more damage than good. Almost nothing is impossible; nevertheless, discretion should be used.

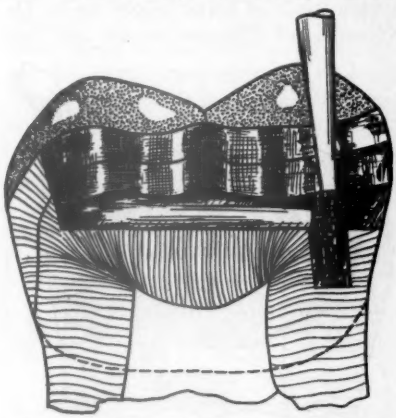

Fig. 4.—Penetration along interproximal dentino-enamel junction with bibeveled tapered fissure bur to approximate position of cervical floor.

Proper cavity preparation is the first essential for a good amalgam filling. In speaking of cavity preparation, I shall illustrate a Class II case because that embraces nearly every problem with which one is faced. One can probably "get by" with minor flaws in inlay work, such as having a shortage in the seat portion of the occlusal step, but, with

amalgam, exactitude is essential if the restoration is to be permanently successful.

There seem to be, in this respect, two schools of thought: those who hold rigidly to the principles laid down by Black and those who believe in a modified Black type of preparation. Certainly, the basic principles of Black should be enforced; that is, outline form-extension for prevention, resistance form, retention form, etc. Weak overhanging enamel walls should be removed and, wherever indicated, a cement lining or step should be used. I prefer the slight modifications of Black taught me by Dr. Nylander, of Chicago, which are illustrated in the accompanying drawings.

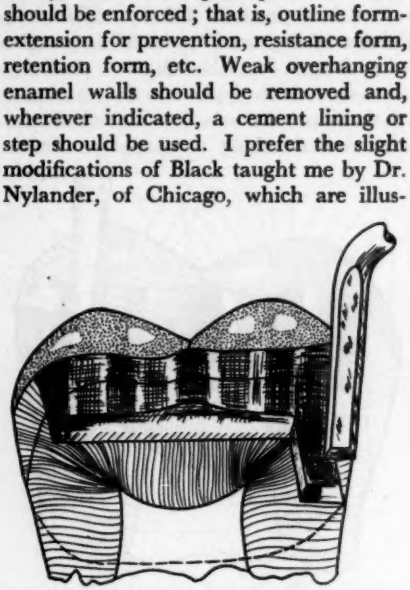

Fig. 5.—Enamel hatchet breaking away interproximal enamel undermined as in Figure 4.

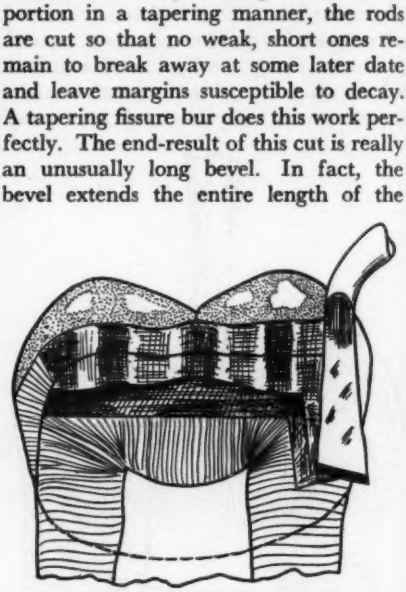

Fig. 6.—Obtaining cervical retention with opposite gingival margin trimmers used to finish cervical margins; angles exaggerated for purposes of illustration.

The easiest way to start the average proximoclusal cavity, apart from opening large carious areas immediately with proper chisels, is to use a small bibeveled drill from the occlusal surface through the marginal ridge, penetrating along the dentino-enamel junction approximately as far as the gingival floor. A 700 or 701 cross-cut fissure bur is then used, extending buccally and lingually. This undermined section of interproximal enamel is then broken out with a chisel, after which the cavity is extended buccally, lingually and cervically with suitable chisels and hatchets. The occlusal step is extended with either the 700 or 701 cross-cut fissure bur or undermined with a 33½ or 34 inverted cone bur and enlarged to the desired width with hand-cutting instruments, tapered fissure burs or stones.

Figure 1 shows the direction of the enamel rods. By cutting the occlusal portion in a tapering manner, the rods are cut so that no weak, short ones remain to break away at some later date and leave margins susceptible to decay. A tapering fissure bur does this work perfectly. The end-result of this cut is really an unusually long bevel. In fact, the bevel extends the entire length of the enamel rods. If one does not cut enamel in this manner, as some operators advocate, there is a relatively short, wedge-shaped edge of amalgam, which may, under the forces of mastication, chip away from the margin, the ultimate result being the same as with a strictly parallel enamel wall; i.e., bad margins. The slightly tapered enamel wall gives bulk and strength at one of the two points where it is most needed.

Kornfield has presented an excellent treatise in which he has illustrated his reasoning in cavity preparation for amal-

gam to obtain the theoretical ideal of a 90-degree, or right, angle for maximum strength of both the enamel rods and the amalgam. With his modification, a 100-degree angle is obtained for the enamel cavosurface angle and an 80-degree angle for the amalgam. He has then a binangled floor and undercuts in the dentin with an inverted cone bur as illustrated.

This somewhat radical departure from nearly all previous teaching raises several objections, in my opinion. In the first place, additional undercutting is unnecessary, as the pulpal floor of the cavity is already considerably wider than the surface width. Secondly, a constant succession of skilled operators and investigators from Black to the present time have consistently maintained the importance of a flat floor, with only a few minor exceptions. Lastly, Kornfield diagrammatically illustrates his premise with straight lines, whereas such do not occur on the natural occlusal surface (except in cases of abrasion and erosion), the convex cusp being the rule, and proper carving will result in an 80-degree to 90-degree angle of the amalgam at the cavosurface angle.

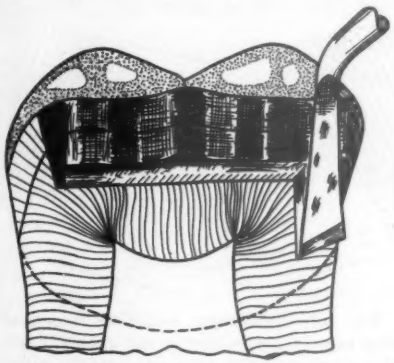

Fig. 7.—Finishing cervical margin; angles exaggerated for purposes of illustration.

Another place in which strength is needed very much and which is most often neglected is the axiopulpal line angle. In the first place, the occlusal portion of a step cavity should be from 1.5 to 2 mm. in depth, and when one carves the marginal ridge, the thinnest portion of the filling will be at this axiopulpal line angle, the interproximal portion of the filling being subjected thereby to fracture from the occlusal portion. Also, the neck of the occlusal step should be at least one-third as wide buccolingually as the interproximal portion. If it is any narrower, it will be too weak to support the greater bulk interproximally, and one must remember that the marginal ridge area of the filling is subject to a tremendous amount of strain—both from direct thrust action and from torsion during the masticatory process. With the strong, tough golds on the market today, one can have a narrow neck to this occlusal portion for gold inlay work, but not so with amalgam.

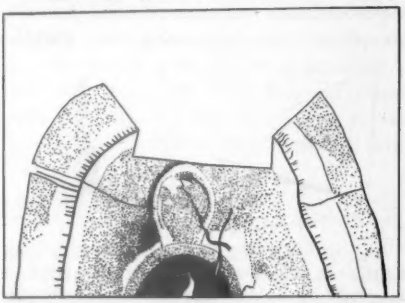

Fig. 8.—Horizontal cross-section illustrating direction of buccal and lingual enamel walls and slight undercutting in dentin, obtained by using gingival margin trimmers illustrated in Figure 6.

The buccal and lingual walls must likewise be cut parallel to or in the direction of the long axis of the enamel rods, as may be seen in Figure 2. The walls can be finished with either sharp chisels or sandpaper disks, provided they are clean, true and sharp. Moreover, the walls must be made in one continuous sweep with the gingival floor of the enamel, and parallel to the long axis of the rods, this being accomplished with the gingival margin trimmers.

We next come to resistance form, which is most important. Floors and walls should be flat and straight. Discrepancies should be compensated with a cement lining. If cutting is to be deep, a sedative is applied and whatever else is necessary will be indicated according to one's judgment.

Then comes retention form. It would seem superfluous to mention that this form is vital were it not for the fact that, in perusing the literature on this subject, I have found a number of writers who do not think that any special retention form is necessary. They apparently rely almost entirely upon the elasticity of dentin as is done for gold foil. I believe that occlusal retention should be obtained with an inverted cone bur and interproximal retention should be accomplished by sharpening and slightly undercutting the buccal and lingual axial line angles, with the reverse gingival margin trimmers used on the cervical margin. That is to say, in a mesial cavity, one uses the distal trimmers for obtaining retention. Finally, a slight incline is made on the cervical floor in the dentin, this also being accomplished with the cervical margin trimmers.

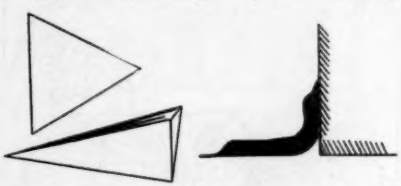

Fig. 9.—Left: Shape of wedge used with matrix in Class II cases. The wedge is inserted from the lingual aspect. Right: Spheroiding of amalgam at margins and line angles which results unless very small packing instruments are used.

My reason for desiring retention both occlusally and interproximally is that I do not think occlusal retention alone is sufficient. Secondly, assuming that one is filling a mesial cavity, if it is ever necessary to fill the distal portion of the tooth, one can cut into the occlusal area with relative equanimity without undue weakening of the mesial filling.

Having finished the preparation, and assuming that the field is isolated, one should complete the toilet of the cavity. Sometimes, the matrix should be adjusted first, because in extensive cavities bleeding may result during the placing of the matrix. At least, shall I say, the toilet of the cavity, varnishing, cleansing of margins, etc., must be done, and because this is fundamental I will not bore you with details already well known. Nevertheless, at this point, some mention should be made of one of the major criticisms of amalgam restorations; i.e., the almost customary gross discoloration associated with the use of the material. The aver-

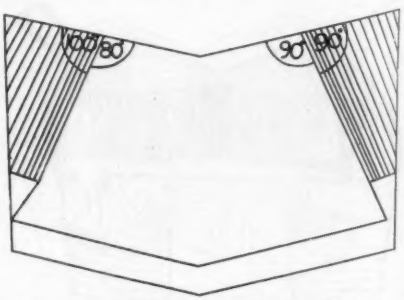

Fig. 10.—Technic for obtaining theoretical ideal of 90-degree angles for maximum strength of both enamel and amalgam, actually utilizing 100 degrees for enamel and 80 degrees for amalgam. (Kornfield.)

age layman believes, and is even taught by some dentists, that amalgam fillings always turn the tooth black. Most of them do, but the onus should not be placed on the material *per se*. It is due to the almost universally slovenly manner in which cavities are prepared, the way the material is mixed, the manner of packing and the lack of finishing and polishing. Many operators do not remove all carious material thoroughly, but rather rely upon the liberal application of silver nitrate to the cavity immediately prior to insertion of the filling, as a means of arresting the progress of the

decay, which the operator should have removed. This procedure is to be condemned heartily, although I would be one of the first to state that silver nitrate possesses a high and invaluable position in the dental pharmacopeia.

The two major criticisms of the aforementioned procedure are, in the first place, that if any bulk of soft carious dentin treated with silver nitrate is allowed to remain in the cavity, the carious process will be retarded, but will not be entirely inhibited. As a consequence, the often-called recurrent caries will take place under the filling. (Such work scarcely merits the term "restoration.") This is not "recurrent caries," but the original carious material turned jet black. Secondly, the moment silver amalgam comes in contact with silver nitrate, the latter is reduced to silver oxide, and even though all soft carious material has been removed, the black precipitate will discolor the tooth substance.

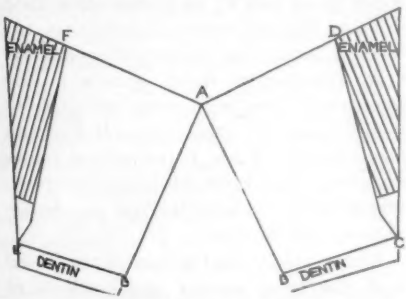

Fig. 11.—Technic for obtaining theoretical ideal of 90-degree angles for maximum strength of both enamel and amalgam, actually utilizing 100 degrees for enamel and 80 degrees for amalgam.

Silver amalgam, a dark gray material, naturally will impart a slightly darker tinge to a tooth. It will show through thin undermined buccal walls and in similar places, but then it is obvious that its use is contraindicated in these positions or, if used, that an adequate cement lining should be employed.

The selection of a proper matrix, its trimming, fitting, adapting and wedging, too often receive inadequate attention from the average operator.

One of my colleagues states that he spends more time in fitting and adjusting the matrix than he does in filling the cavity. A good matrix goes farther toward making a successful filling, granted all other things are equal, than almost anything else in the entire procedure and saves a tremendous amount of time, trouble and inconvenience to both patient and operator. Wherever possible, I use a matrix retainer and a band of 0.001 thickness. Sometimes, it is necessary to use other methods and to resort to all sorts of devices.

For mesioclusodistal fillings, I use copper, celluloid, etc., usually using a complete band. Because of its affinity for mercury, I prefer not to use copper, if its use can be avoided. It is amazing to discover how well the celluloid bands will hold up if there is no tear to begin with and they are adequately supported.

With the matrix in position, the cervical margin is wedged with a soft wooden wedge cut to the shape of the interproximal space. It is inserted from the lingual embrasure, the widest portion, and wedged very tightly. This tight wedging affords some separation. Naturally, it is infinitely easier to restore contact if one has had the opportunity to use conventional methods of separating beforehand. This, however, is not always either possible or practicable.

The matrix is then burnished to contact, particularly over the contact point. When one is satisfied, it is proper to proceed with the filling process. The first moment that I fit a matrix, I know whether it is going to be satisfactory and, if it is, I direct my assistant to start mixing.

Some operators always use a thin layer of thin cement in every cavity in conjunction with the amalgam, calling the result "an amalgam inlay." That method,

which I use frequently, is described in detail elsewhere.

With regard to the choice of an alloy, certainly only a high-grade alloy conforming to Federal and A.D.A. specifications and mixed in proportions advocated by the manufacturer should be used. As Hollenback has pointed out:

> Some manufacturers do not supply sufficiently explicit instructions regarding trituration of the alloys. Thus a comparative study with two different alloys bearing the same instructions in regard to trituration showed that one required long mixing range, while the other required a much shorter mixing period. One of the commercial sample of alloys, showing approximately 1 micron of expansion with thirty seconds of trituration, when mixed according to the furnished instructions showed great shrinkage. Tests disclosed that the newer type of high silver content die alloys are practically neutral as to shrinkage and expansion. They are therefore ideal for the work for which they are intended.

Likewise, only a high-grade mercury should be employed, and there must be more than sufficient amalgam to meet the requirements of the cavity. It is better to have too much than too little. The medium-setting alloys will meet the needs of most operators, but a quick-setting one can be used if desired. The time of setting hinges on the personal equation, depending primarily on the speed with which one works.

We now come to the subject of mixing time, and one secures a variety of opinions from various authorities. All sorts of times for mixing are given, and what alteration in our technic will result from the work of Taylor and others at the U. S. Bureau of Standards, I do not know. Taylor maintains that, if shrinkage is to be avoided, combined mortar and pestle and hand mixing should not be longer than three minutes. It follows that the use of the mechanical mixer shortens this time considerably. Yet, in my experience, all men who do really first-class amalgam work mix the amalgam for fully three minutes. Arroyo, of Paris, who uses a mixer on the handpiece for a full three minutes, maintains that no one can consistently use a mortar and pestle for three minutes with the same results at all times. Certainly his work is a credit to any man, but Arroyo asserts that his results are attributable to the use of pure silver plate or of wire for overcoming contraction. This premise should be investigated scientifically.

At this point, I must digress a little and mention the work of Arroyo in detail. Bull, in 1938, advocated a technic of using 90 per cent silver plate cut to suitable sizes as a reinforcing medium, inserting these pieces in the soft amalgam during the packing process. This technic has been employed by Arroyo for many years, but he uses pure silver plate or wire. His amalgams are works of art. He has done slice preparations and has even constructed fixed bridges in the mouth with this reinforcing principle to demonstrate the great strength that can be obtained. These experimental pieces of work have been subjected to every sort of strain without fracture or change of form and volume.

I have always had my amalgam mixed with the hand mortar and pestle until it becomes a dull silver color and, as far as one could tell, thoroughly amalgamated; finishing with hand mixing. With the latter, one must be certain that the hands are clean and not greasy or sweaty. Harper has advocated this method many times.

The packing technic used is that advocated by Arthur W. Gray. The proportions recommended by the manufacturers usually result in a very soft mix with an excess of mercury. This mix is rolled in the form of a spindle and the pointed end is cut off with the tweezer or carrier and is placed at the bottom of the cavity, point first. With suitable size pluggers, this soft mass is carefully tamped over the floors and cervical margin to the buccal and lingual

walls and into the axial angles of retention. As the mass is too soft at this stage, force is contraindicated.

A second piece of the amalgam is taken in the carrier, some of the excess having been squeezed out to make it a little drier, and is inserted in the cavity. The same tamping action is utilized, "stepping" the action of the plugger from the center toward and along the walls. The tamping should start in the middle and work toward the walls, the operator using a small plugger that will fit into all the angles. Each tamping stroke should overlap the preceding one. This overlapping tamping action must be carefully continued to the walls to obviate any void caused by air and mercury bubbles. Because amalgam obeys the laws of all plastics, with a decided tendency to spheroiding, it is particularly essential that small instruments be used, which will force the plastic mass into all angles. The excess soft mercury is wiped out of the cavity with the side of the plugger. Successively drier portions of amalgam are utilized, but not so dry that the plasticity is lost. The tamping action is continued until the cavity is filled up to the occlusal step. Then the occlusal portion is filled in a manner similar to that used for gold foil. This is the only technic resulting in a filling that will withstand the water pressure test of Van Den Berg, of The Hague, which is analogous to Harper's air test with the exception that water is used.

In my early days, I used to make the last bit of amalgam as dry as possible by squeezing it in the chamois. The difficulty with this method is that, unless one has underneath a quantity of very soft amalgam which will provide sufficient excess mercury to be taken up by the very dry piece and make the latter plastic, the result will be a very dry and brittle occlusal portion, which will probably chip away at the marginal ridge at a later date. Besides, forcing the mercury out of a well-amalgamated portion of the material and subsequently adding more mercury, which is what this action means, is almost as bad as finding that the amalgam is beginning to crystallize before the packing is completed and more mercury is added. The result, as pointed out by Harper, is a very weak material. The technic taught me by my predecessor, and subsequently by Gray, was to continue to pile up the moderately dry amalgam and, now using a fairly large plugger, to continue to tamp and to exert pressure. This results in a mass which is so dense that the exercise of all the force at one's command on a small plugger point cannot even dent the surface.

The excess on the occlusal portion is now trimmed down with suitable sharp carving instruments and the matrix is removed. My first action after the removal of the matrix is to finish carving down the marginal ridge with a flat, rounded plastic instrument, drawing the strokes from the adjacent tooth toward the filling, gently massaging the mass to a tight contact and compensating for any slight discrepancy not accomplished by wedging, burnishing the matrix (even thinning the matrix in some instances) and very tight packing. Usually, these three forces will separate the teeth sufficiently that there is no need to worry about contact. If one is at all dubious, he should use a separator after the matrix is adjusted. However, for the average case, this is not necessary.

The second step is to use those useful instruments, the Perry trimmers, and carve interproximally and cervically, if trimming is necessary. If no trimming is required, I at least use the smooth, rounded trimmers, gently drawing them from the amalgam toward and over the margins.

Lastly, I carve the occlusal surface to what I think is necessary, check the bite with articulating paper and make whatever alterations are needed, being abso-

lutely certain that there are no high spots. Then, with cotton, I wipe the surface free of débris. Sometimes, I burnish very lightly to make certain that the amalgamated particles of alloy are packed tightly over the margins. One should not burnish very hard, however, because that action draws the mercury to the surface and the objective of strong amalgam margins will be defeated.

The patient is dismissed and, at a subsequent sitting, at least twenty-four hours later, the restoration is finished with stones, finishing burs, disks, etc., and polished with the same degree of care with which one would finish any other piece of fine workmanship. If a highly polished matrix is used, little polishing interproximally is necessary.

The subject of economics naturally enters the picture. To my mind, there is only one method of determining the fee for such work and that is on the time basis. If one gives the service entailed in producing a piece of high-grade work, one is entitled to adequate compensation within the economic sphere of one's patients. Some fillings may require only twenty minutes, while others may require an hour or more. It seems, therefore, illogical to charge a certain amount per filling. We are not handing a staple article of commerce over the counter. We are performing a definite operative procedure and service which varies with each tooth and each individual. The compensation should be in accordance with the service.

In conclusion, allow me to point out what has probably been obvious from the wording and tone of this paper: Silver amalgam deserves a well-merited place among the filling materials at our disposal for the restoration of diseased and lost tooth structure, but is all too frequently misused. Its maximum advantages depend to a great extent on the following: correct diagnosis; attention to cavity preparation and its attendant details; fitting and adjustment of the matrix with precision; mixing and packing of the amalgam according to the physical laws which the material obeys, and finishing and polishing of the completed restoration with the same care and attention given other filling materials.

Finally, having given of our best to utilize the best the material offers, let us charge a fee based on the service that has been rendered the tooth and the patient and not simply a fixed rate for a "silver filling." The custom of charging a fixed fee for amalgam fillings has, I believe, been responsible for many of our failures.

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THE TEMPOROMANDIBULAR JOINT IN RHEUMATOID ARTHRITIS

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THE list of disorders that produce pain and loss of motion in the temporomandibular joint is of considerable length. Chronic arthritis is the most common cause of chronic joint pain.

For fifteen years, one of us (L. A. R.) has been attending dentist in an institution devoted to the diagnosis, treatment and outpatient care of the chronic arthritides, and we draw the material for this discussion from long-continued personal observation and care of a large group of patients with chronic arthritis. The paper will deal with patients with rheumatoid arthritis, which is a progressive systemic disease of unknown cause characterized by inflammation of the joints. It affects two or three women to one man. Usually, the disease onset is between 20 and 40 years of age and in persons of slight build. It is characterized by remissions and exacerbations, with increasing damage to the joints with each attack. The cure is unknown, but much can be done to improve the general health of the patient as well as to protect and improve his joints.

The temporomandibular joint is involved in about one-half of the patients with rheumatoid arthritis, and when a patient with generalized joint disease complains of pain, limitation of motion and sometimes swelling of both the temporomandibular joints, this diagnosis must be considered. Rarely is the temporomandibular joint the first area involved, and the dentist who encounters patients in his practice with ill-defined syndromes of "facial neuralgia" or "stiffness of the jaw" must consider these complaints as possible early symptoms of rheumatoid arthritis.

Too often in the past, the dental and medical professions have been interested simultaneously in the case of rheumatoid arthritis only when a focus of infection in the mouth was thought to be affecting the systemic condition.[1] Physicians and dentists treating rheumatoid arthritis should have a knowledge of the anatomy and pathology of the joint and the treatment of the condition and be able to make a prognosis of this condition, as the patient with this joint involved is very apprehensive, fearing eventual complete limitation of motion such as occurs in other joints.

In the past, attention has been directed to the temporomandibular joint when it was affected by acute and chronic infections involving the joint itself or surrounding structures and which might lead to complete limitation of motion. Tumors and trauma may also lead to the same end.[2, 3, 4]

Pathologic processes in the temporomandibular joint resulting from malocclusion may simulate many neurologic and otologic disorders. These changes are usually those of osteoarthritis, the result of wear and tear, not rheumatoid arthritis. Costen[5] and others[6, 7] have shown that ear symptoms predominate in patients with edentulous mouths and that symptoms of pain are most common in natural malocclusion or malocclusion from the loss of molar support on one side. Each decade produces a greater predisposition to these symptoms as the

wear on the natural teeth or loss of them increases temporomandibular joint wear and tear. The majority of Costen's patients were over 40. The symptoms or signs referable to the ear and resulting from malocclusion are local stuffiness, impaired hearing, herpes, tinnitus and dull pain. Symptoms consisting of headache, sinus pain, burning sensation in the throat, tongue and side of the nose, a rare decrease or increase of the saliva, herpes of the buccal mucosa and trismus[8] have also been described as resulting from malocclusion.

Despite the fact that temporomandibular symptoms and even partial or marked limitation of motion of this joint occur in rheumatoid arthritis, the subject has received scant attention in the dental and the medical literature. In 1764, Baron Haller in "Elementa Physiologiae" described erosion of the cartilage and twenty small bodies (globules) in the temporomandibular joint.[9] Kazanjian[2] has reported three cases of bilateral "complete ankylosis" occurring in rheumatoid arthritis. Buchman,[10] who recently surveyed the temporomandibular joint from the orthopedic surgeon's point of view, states that it is not at all uncommon for it to be involved in rheumatoid arthritis. He reports one case, but apparently has had experience with many. Reisner[11] illustrated faulty temporomandibular articulation by the roentgenographic findings in this joint in one patient with rheumatoid arthritis. Bellinger[12] states that temporomandibular joint involvement is "not at all uncommon" in rheumatoid arthritis. He feels that it is one of the last joints to be involved; but this, in our experience, is not always true. Aside from these individual reports, this subject has not been considered carefully as far as we are able to ascertain.

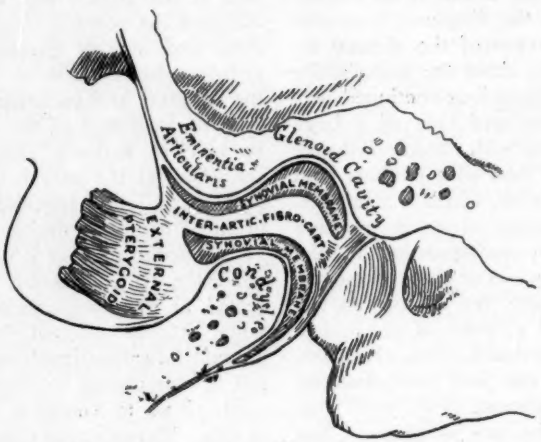

Fig. 1.—Vertical section of temporomandibular articulation. (After Gray.)

The temporomandibular joint is ginglymo-arthrodial (hinge-sliding). (Fig. 1.) The head of the condyle of the mandible moves against the glenoid fossa and the articular eminence of the temporal bone. These two joint surfaces are separated by a complete fibrocartilaginous disk, a thin oval plate the upper surface of which is concavoconvex from before backward to accommodate itself to the mandibular fossa and the articular tubercle; while its under surface, in contact with the condyle, is concave. This disk is attached at its circumference to the articular capsule and, with the

latter, divides the joint space into two separate synovial spaces, the upper being larger and looser. The mandible may be depressed, elevated and carried forward or backward, and a slight amount of side-to-side motion is permitted. In a slight opening of the jaw, the lower of the two joints is used. When the mouth is more widely opened, the lower joint still acts on a hinge and the upper joint has a gliding motion, the disk and condyle sliding forward on to the articular tubercle, and simultaneously the condyle revolves on the disk. In grinding or chewing, one condyle and its disk moves forward and the others backward and, in addition, the condyle undergoes

Fig. 2.—Subluxation of lower jaw in patient with rheumatoid arthritis of thirteen years' duration.

vertical rotation on the disk. The joint is supported by the temporomandibular (external lateral) and the sphenomandibular (internal lateral) ligaments, while the stylomandibular ligament is an important accessory to the joint. The nerves of the temporomandibular joint are the auriculotemporal and masseteric branches of the mandibular nerve.[13] The anatomic features of this joint have been presented in great detail because the presence of the combination of both a sliding hinge motion and a complete interarticular disk differentiates this joint from all others usually involved in rheumatoid arthritis.

The course of the disease in this joint is no different from others involved in rheumatoid arthritis as far as we know. The clinical, roentgenographic or postmortem study is difficult, however, owing to the anatomic location. Areas of periarticular edema or thickening or hydrarthrosis can be palpated only with difficulty. Generalized osteoporosis in this disease and superimposition of the joint on the skull make roentgenographic study of less than the usual value. Permission for postmortem study is seldom obtained for esthetic reasons. However, the clinical signs, symptoms and course point to a pathologic sequence similar to that found in other joints. Synovitis

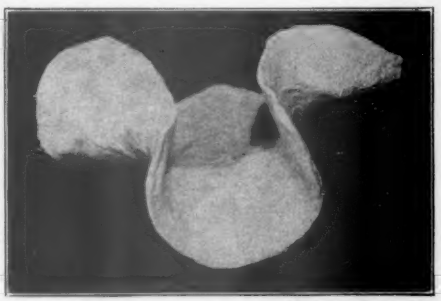

Fig. 3.—Plaster collar used to prevent subluxation of jaw.

is probably the most important primary pathologic change. Then proliferation of the synovium, periarticular edema and hydrarthrosis may follow and produce local pain, tenderness, swelling and irritative phenomena in the nerve supply to the synovium.

The interarticular fibrocartilaginous disk has no nerve supply[14] and cannot cause referred pain, but it is intimately associated with the symptoms and eventual prognosis of rheumatoid arthritis of this joint. While it is usual to have limitation of motion subsequent to swelling and obliteration of the joint cavity, complete limitation of motion

or ankylosis has not been observed in our series of 515 patients. The writings of others[2, 10] confirm this finding. We ascribe it to the interposition of the disk. However, in certain individuals, when there is a lack of molar support or normal occlusive balance, the disk is perforated or completely destroyed by the upward pull of the masseter muscles on the mandible[11] and, if this sequence of events occurred before the onset of rheumatoid arthritis, bony ankylosis could be expected. It is, however, unlikely, as these degenerative changes in the disk usually occur at a time of life late for the onset of rheumatoid arthritis.

Unfortunately, the term ankylosis has been widely used to mean both limitation of motion and immobility. We feel that only its correct definition should be retained, and in this paper ankylosis has been used to indicate absolute immobility or complete limitation of motion. Our cases are divided into two groups, those with partial and those with marked limitation of motion. Partial limitation of motion infers more than 5 mm. of opening power; marked, less than 5 mm. Even our most severe cases have shown some motion, however slight. Kazanjian[2] reports three cases of "complete ankylosis" following rheumatoid arthritis, but he defines "complete ankylosis" as less than 5 mm. of opening power. We believe that this precludes actual bony ankylosis because, in other joints, this would cause loss of motion.

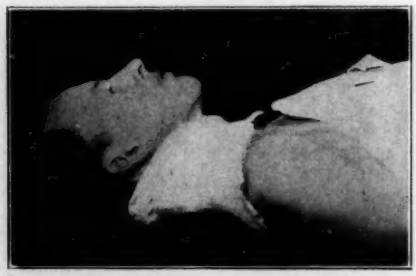

Fig. 4.—Collar as worn by patient.

Limitation of motion of the temporomandibular joint in patients under 15 leads to deformity of the jaw through hypoplasia of the mandible. Hypoplasia has been explained in three ways: 1. The disease of the joint directly affects an important growth center in the condyle. 2. Lack of function leads to hypoplasia.[2] 3. According to the dental literature, the presence of misplaced and unused teeth in the young affects mandibular growth.[13]

In older patients, rheumatoid arthritis of this joint may lead to subluxation, which, when severe, may cause the mandible to recede as much as 1 inch (Fig. 2). This is probably due basically to intrinsic pathologic changes in the joint itself and the generalized muscular atony and atrophy associated with the disease process. The pull of gravity plays an important part in patients confined to bed, subluxation being most severe in patients kept in the supine position. The integrity of the temporomandibular joint is also threatened by the loss of normal occlusion, brought about by the necessary or unnecessary extraction of teeth.[16] It is well known that the loss of a single tooth can distort the temporomandibular articulation[11] and this fact may contribute to subluxation.

In order to clarify the pathologic sequence and clinical observations and coordinate them with the symptoms and treatment, the cases of rheumatoid arthritis with temporomandibular involvement may be divided into three groups: transitory, acute and chronic, as shown in the accompanying table.

We have found the transitory type of involvement of the temporomandibular joint in 8 per cent of cases. It is found in slightly or moderately affected patients and would be most apt to be seen by the practicing dentist. Opening is limited to about 10 mm. for from one to three days. Neuralgic discomfort may be referred to the ear, muscles of the

neck, teeth, zygoma, maxillae, mandible, temporal region, occiput or the joint itself. These early diffuse symptoms, if unaccompanied by limitation of motion, may be confused with other syndromes of head and neck pain.[5, 7, 11] Complete rest of the closed jaw for from two to five days, with application of heat at the site of the joint, gives relief and the prognosis is very good.

The acute type of involvement of the temporomandibular joint in rheumatoid arthritis is the most important, because upon the proper handling of this group rests the eventual function of the jaw. The acute type of disease occurs in 20 per cent of cases of rheumatoid arthritis. The early symptoms are similar to those described above in the transitory type, but are usually more severe, and eventually the pain localizes in the area of the joint anterior to the tragus and then limitation of motion makes the diagnosis obvious. Local pain, warmth and swelling result. There can be excruciating pain and, in some cases, trigger points comparable to those of tic douloureux are present, usually in the area of the mental foramen. This period lasts from six to ten weeks and, during this time, there is limitation of motion, usually to less than 10 mm. of opening. Because the patient fears complete ankylosis of the jaw, he performs voluntary stretching exercises, which only serve to aggravate the condition by producing severe muscle spasm and pain. The patient should be impressed with the fact that intelligent conservative treatment in cooperative patients has always led to functional success. Physiologic rest is of paramount importance. The teeth should be in centric occlusion, barely separated and held that way even in talking or eating. In some, a well-rounded liquid diet seems desirable. Local heat over the joint is helpful. The patient must be told of the importance of not stretching his jaw to see how he is progressing. In a surprisingly short time, usually a few days, there is marked lessening of the muscular spasm and pain and mild exercises are indicated. These consist of chewing gum exercises for an hour or two a day, increasing slowly, but always keeping within the limits of fatigue or actual pain. A soft gum is used first, then a harder gum. Finally, two or three sticks may be used rather than one.

After the larger amount of hard gum can be used for two or three hours without fatigue, a rubber horseshoe cut to fit the shape of the occlusal line is used. This

DATA BASED ON ONE HUNDRED CONSECUTIVE ADMISSIONS FOR RHEUMATOID ARTHRITIS

Type	Percentage of Rheumatoid Arthritis	Degree of Generalized Joint Involvement	Percentage of Patients with Temporomandibular Involvement	Duration	Limitation of Opening of Jaw Mm.	Prognosis with Proper Treatment
Transitory	8	Mild or Moderate	15.8	1-6 days	25 or less	Excellent
Acute	20	Moderate to Severe	39.2	6-10 weeks	Usually 10 or less	Good
Chronic	23	Severe	45.	More than 4 months	25 or less	Fair (good with surgical treatment of "burned out" group)
	Total, 51					

is made of soft sponge rubber, one-quarter inch in thickness. Increasingly firm rubber is used and the device is kept in the mouth several hours a day. The period of slowly increasing function of the jaw after the acute stage lasts from one to two months, rarely longer. A caliper or other measuring device is used to record progress, and the measurements are made between opposing incisors.

Until this writing, we have always had good functional results even after successive acute phases when the above régime has been carried out. However, it is only fair to say that while a good functional result (opening of more than 25 mm.) has always been obtained, most of the patients lost a small amount of motion at the upper limit of opening. The following case represents this group.

A woman, aged 31, single, Jewish, entered the Robert Breck Brigham Hospital January 23, 1940, with progressive rheumatoid arthritis, which had started thirteen months before admission. Elbows, fingers, wrists, knees and ankles were involved at the time of entrance. Despite efforts directed toward improving the general health, she had a low-grade fever and the joint condition remained about the same. Laboratory findings were consistent with the diagnosis of rheumatoid arthritis. During March and for the first few days in April, she had severe nausea with vomiting. She was first seen April 9, with a two-day complaint of painful, stiff jaws following a severe attack of vomiting. On this day, there was limitation of opening to 18 mm. and slight pain. Rest, massage with chloroform liniment and dry heat (hot water bottle) were started, being continued until May 28. The intervening measurements of opening power were: April 23, 22 mm.; April 26, 23 mm.; April 30, 23 mm.; May 5, 20 mm.; May 7, 25 mm.; May 17, 27 mm.; May 28, 30 mm.; June 4, 32 mm.; June 11, 34 mm.; June 14, 34 mm.; June 21, approximately normal.

May 28, owing to a decrease in pain, chewing exercises were slowly started and stretching instituted. On the last examination, June 21, the range of motion was approximately normal and without pain.

This case history is typical of an acute course apparently started by trauma of the joint from an attack of severe vomiting. Trauma, a frequent forerunner of rheumatoid arthritis of the temporomandibular joint, may be brought about by any strain such as vomiting, natural malocclusion or the wearing of ill-fitting dentures.

When opening of the jaw is limited to less than 25 mm. for more than four months, the condition should be classed as chronic. Chronic partial or marked limitation of motion of the temporomandibular joint is found in 23 per cent of patients entering for medical or orthopedic care.

These patients may have limitation of motion due either to an "active" arthritic process in the joint or old mechanical dysfunction on the basis of adhesions or damaged joint surfaces. In those patients with a chronic "active" process, the treatment of heat and rest as outlined in the consideration of the acute type should be carried out and exercises begun cautiously. This larger group of chronic cases respond moderately well to treatment and a functional result is usually obtained. One patient in this incompletely treated group progressed to almost complete limitation of motion. Patients with chronic limitation of motion of a mechanical type are fewer, and, in these, strenuous stretching exercises and forcible wedging have been of value. However, the results are not so satisfactory and it is necessary to continue the exercises *ad infinitum*. The presence of firm fibrous adhesions militates against the success of conservative treatment, and it is in this last group that operative interference is indicated and is successful. Kazanjian[2] has described successful resection of the neck of the condyle near its head and insertion of a fascia lata transplant in the area of the resected bone. Function of the temporomandibular joint was improved by this procedure in his cases.

Treatment for subluxation of the mandible is rarely necessary in the acute stage, but often so in both types of the chronic stage. The patient is sometimes the first to note that his incisors do not meet. Subluxation should be treated by a stay plate similar to that used by orthodontists to lock the upper and lower incisors, but if limitation of motion is already present, an open plaster collar (Fig. 3, a, b) which rests behind the shoulders of the supine patient and presses against the angle of the mandible is useful. The patient rests in this when in the supine position.

While the ease with which success is obtained by these plans of treatment is partially dependent on the unpredictable course of the disease, we feel that careful, intensive, conservative treatment at the transitory, acute and chronic "active" stages of the disease will prevent the serious complication of marked limitation of motion and make late plastic operations unnecessary. This statement is true because of the unusual anatomic relations of the joint (sliding hinge motion and a complete interarticular disk). Thus, this joint is differentiated from all others that may be involved in rheumatoid arthritis.

SUMMARY

1. The temporomandibular joint was involved in 51 per cent of 100 consecutive admissions for rheumatoid arthritis.

2. Complete limitation of motion (ankylosis) rarely, if ever, occurs in the temporomandibular joint.

3. Conservative and operative treatment are employed in the three types of involvement.

4. The unusual anatomic relations of the joint permit a favorable prognosis, and a good functional result may be expected when the treatment outlined is carefully completed.

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Robert Breck Brigham Hospital.

CAVITY PREPARATION BASED ON HISTOLOGIC AND BIOLOGIC PRINCIPLES

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THE purpose of this paper is primarily to present another angle in the discussion of different types of cavity preparations based on the histopathologic evaluation of dental caries.

I am no authority on operative dentistry; hence the suggestions presented concerning the slight modification of cavity preparation may seem presumptuous. However, these suggestions are made in order to evoke discussion and not as definite recommendations.

Cavity preparation and methods of placing fillings have been based primarily on engineering principles. This is right and necessary, because the repair of carious teeth is a technical procedure. But now it is beginning to be realized that there are histologic and biologic factors also in the filling of teeth. If there is a more general recognition of this truth, it will lead to a further improvement in some operative procedures, save more dental pulps and cause less discomfort to patients.

G. V. Black[1] was the first scientist in the dental profession to apply a knowledge of histology to cavity preparation. Cavities prepared according to his rules will have strong enamel margins, which will increase their resistance to fracture and secondary caries. The relation of the dentinal tubules to cavity preparation, however, has received no consideration in the past.

This paper will include a number of topics that have a bearing on cavity preparation: (1) the relation of dentinal tubules to permanence of fillings; (2) the histologic aspect of cavity form, and (3) operative procedures in relation to (a) the age of the patient and (b) the effect of the degree of caries activity.

Dentinal tubules were supposed to contain a fibril, a prolongation of the odontoblast. Now we find, by a special microscopic technic, that, in reality, this fibril is a tube within the dentinal tubule, which contains a fluid.[2] Animal experimentation conducted by William Lefkowitz and me showed that this fluid diffuses through dentin and enamel. These experiments have been described in detail.[3]

The presence of the dental lymph has a bearing on one phase of operative dentistry: The diffusion of this fluid is particularly active in young teeth, probably for the purpose of bringing mineral salts from the pulp for their calcification after eruption.

An example of a young tooth is shown in Figure 1, a section of a third molar. Here, the dentin is quite translucent and the dentinal tubules are only faintly marked. Such a tooth is highly permeable and the pulp is easily irritated by operative procedures.

After the teeth have been in the mouth for five or ten years, the translucency of the dentin is reduced. Figure 2 shows that most of the crown has undergone a change, which we have termed protective

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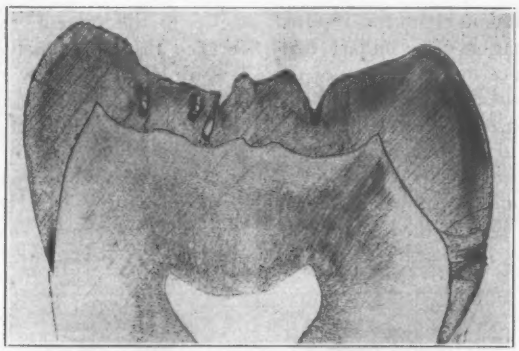

Fig. 1.—Recently erupted third molar having highly permeable immature dentin and enamel. In comparison to Figures 2 and 3, the tooth is highly translucent.

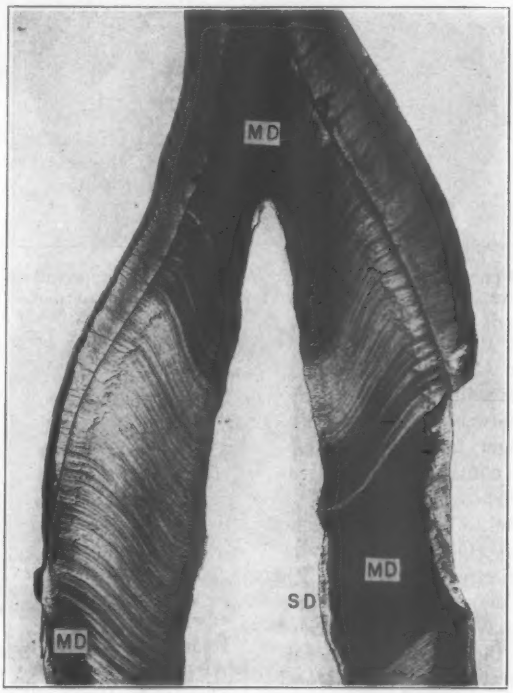

Fig. 2.—"Old" canine with matured dentin (MD). Most dentinal tubules are metamorphosed (blocked), becoming impermeable. There is little secondary dentin (SD).

metamorphosis; i.e., blocking of the dentinal tubules. This area appears quite opaque when viewed under the microscope. The deciduous teeth of children have usually undergone definite metamorphosis. (Fig. 3.) Abrasion of one

cusp of this deciduous tooth has resulted also in the formation of secondary dentin. The difference in appearance of the dentin in comparison with that of the young permeable tooth is striking. (Fig. 1.) A slightly higher magnification of the permeable and blocked condition of the dentinal tubules is shown in Figure 4. The young lymph-filled permeable dentin (LT) is transparent under the microscope, while the blocked or metamorphosed dentin (MT) is opaque.

Fig. 3.—Matured crown of deciduous molar; dentin permeability greatly reduced on account of blocked tubules. Attrition of one cusp caused formation of secondary dentin (SD).

Microscopic examination of metamorphosed dentin shows that many tubules are no longer filled with lymph. (Fig. 5.) They contain opaque areas alternating with transparent ones. This opacity I interpret to be caused by the presence of a gas (G), and the translucency to the dried calcific plug (CP), a remnant of the dental lymph. It seems that when teeth have received sufficient mineral salts for their posteruptive calcification, pulp activity is reduced and the lymph comes to a standstill, decomposes and forms a gas. The opaque areas are separated by occasional calcific plugs that completely block the tubules. This metamorphosis affects the character of the dentin involved by greatly decreasing its permeability or porosity.

Up to the present, the principal difference discovered between young and mature teeth is their varying permeability, and this applies to the enamel as well as to the dentin. Therefore, pulps in young, permeable teeth are much more liable to irritation from without than those in mature teeth. *We are beginning to realize, therefore, that differences in permeability should be factors in operative procedures.* The rapidity with which caries attacks teeth is also related in a definite manner to their permeability. The destructive factor in dental caries, a mouth acid, can penetrate

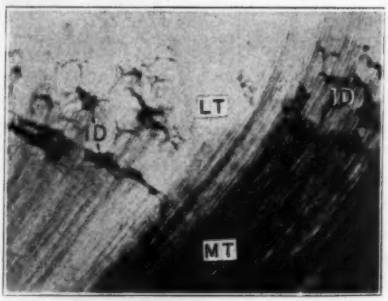

Fig. 4.—Permeable lymph-filled dentinal tubules (LT) and blocked or metamorphosed tubules (MT). ID, interglobular dentin, which is very sensitive to cavity excavation.

young permeable teeth more readily than the almost impermeable crowns of teeth of older persons. Hence, the designation "protective metamorphosis" seems appropriate to the changes which make teeth more resistant to caries. Evidence[4] has been presented that old pulpless teeth have a greatly reduced permeability, which shows that the absence of the dental lymph is a factor in reducing the porosity of teeth. But this is not the only sional bluish, slightly transparent condition of the enamel around older fillings can now be explained by the absence of dental lymph in these areas. Likewise, the occasional fractures of incisal corners can be explained on the same grounds. The manner in which the dental lymph is cut off from certain areas is best shown in photomicrographs of ground sections of teeth. It is the study of ground sections (in contradistinction

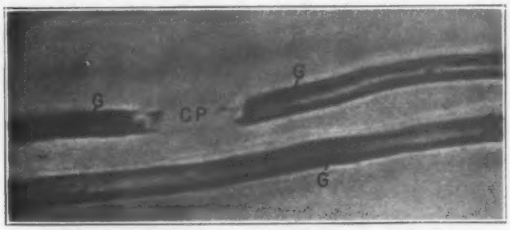

Fig. 5.—Two tubules blocked by gas (G) and calcific plug (CP).

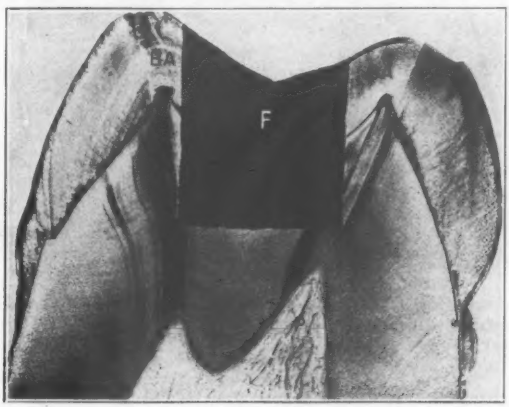

Fig. 6.—Occlusal filling (F) cutting off tubules to marginal areas, making these brittle (BA) if operation is performed on recently erupted tooth. P, pulp.

effect that the absence of the dental lymph has on the dentin and enamel. Another change occurs which is of particular interest to clinicians; i.e., those areas that are deprived of dental lymph finally become more brittle. This condition is significant in explaining the chipping of margins around fillings.

The clinical observation of the occa- to decalcified ones) which has led to the discovery of the dental lymph and which explains the manner in which cavity preparation affects the character of the dentin and enamel. In Figures 6 to 9, the undermining effect of cavity preparation is diagrammatically demonstrated on the enamel margins surrounding various types of fillings.

Figure 6 shows why large occlusal fillings in bicuspids and molars often fail. It will be noted that the filling cuts off the dentinal tubules leading to a considerable portion of the cusps. These areas are printed lighter than those supplied by dental lymph. Clinical experience has long shown that marginal areas chip readily several years after the insertion of such fillings, and now we understand the reason for the failures: these areas become dry and brittle in the absence of the dental lymph. It may seem ridiculous to some that teeth can become dry when they are constantly bathed in saliva. Nevertheless, there is considerable laboratory and clinical evidence to that effect. At this time, it is necessary only to mention the brittleness of old pulpless teeth.[4] They are so dry that they often crack to bits when their surgical removal is attempted.

Teachers of operative dentistry have long realized by clinical experience that the cavity preparation shown in Figure 6 is incorrect and that fillings in such cavities will not protect the teeth. They advocate, therefore, that fillings be extended over the cusps in order to prevent their fracture.

However, smaller fillings on the occlusal surfaces of molars and bicuspids also present the danger of chipped margins, though to a lesser extent. Figure 7 shows such a filling. A study of the direction of the dentinal tubules indicates that even here the marginal areas, particularly on the left, are cut off from their lymph supply, and they should be protected if these areas are subjected to heavy occlusion. The remedy, of course, is to bevel these areas, as shown in Figure 7, so that the filling and not the brittle margins receive the stress. Opinions differ concerning the necessity of a bevel in these areas, because only the direction of the enamel rods has been considered in the past. Our recent observations show that the direction of the dentinal tubules also is important in affecting the permanence of fillings, and that, therefore, a bevel of the cavosurface margins of occlusal cavities is necessary. The type of filling material naturally affects the selection and extent of a bevel.

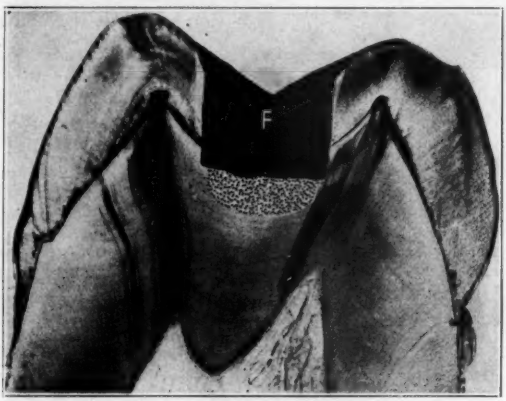

Fig. 7.—Base of cavity leveled off with cement (C). This type of preparation does not cut off so many tubules from marginal areas as that in Figure 6. The bevel protects small brittle areas (printed faintly).

Figure 8 shows the manner in which a filling is placed to repair the damage wrought by caries in a lingual pit cavity on a cuspid tooth. The marginal area

toward the cervix receives its normal quota of lymph because the tubules reach it directly from the pulp. On the other hand, the entire incisal, marginal area (printed faintly) is cut off from the pulp by the cavity preparation. Authorities on operative dentistry can decide whether this is a desirable condition. If

Fig. 8.—Lingual pit filling cutting off tubules to margin near incisal edge. The cervical margin receives its dental lymph and is not brittle. If the walls of a filling are prepared parallel to the dentinal tubules (incisal wall of labial filling), no margins are cut off from the lymph supply. The gingival wall is almost at right angles to the surface of the tooth; which conserves the lymph supply to the gingival margin and also eliminates cutting tooth structure unnecessarily as would occur if the gingival floor were made parallel to the incisal wall. This preparation will prevent the discoloration occasionally noted in the enamel margins. Arrows indicate the general direction of the lymph carrying dentinal tubules.

fractures are observed in this area, it may be made more resistant by preparing the cavity walls on the principle seen in the labial cavity in Figure 8. This suggestion was made by B. O. A. Thomas. The incisal wall of the cavity is parallel to the course of the dentinal tubules, this allowing a normal lymph supply to the area. The gingival wall is almost at right angles to the surface of the tooth; which allows a definite retention along the axiogingival line angle, in the case of gold foil, amalgam or silicate restorations. This general outline

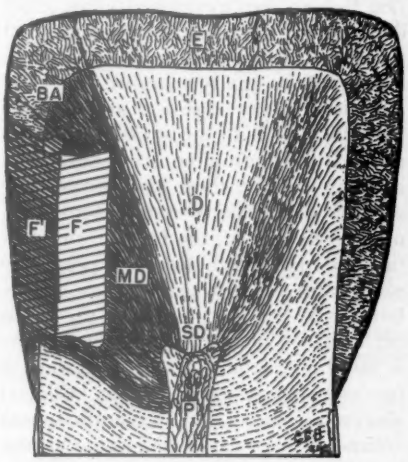

Fig. 9.—Diagram of upper lateral incisor explaining frequent fracture of incisal corner. This area is brittle (BA) owing to the cutting off of the lymph supply by the filling (F). A more shallow filling (F′) does not cut off the tubules to the incisal corner. E, enamel. D, dentin. MD, metamorphosed dentin. SD, secondary dentin. P, pulp.

will have to be modified somewhat for placing porcelain inlays.

Figure 9, a diagram of an incisor tooth with a proximal filling (F), shows the reason for the common clinical observation of the fracture of an incisal corner. It is clear that the cavity, prepared to receive the filling, cuts off the dental lymph from this entire area, causing it to become brittle some years after reconstruction. Suggestions concerning the modification of the cavity form must be left to teachers of operative dentistry.

Leroy L. Hartman believes that the incisal corners can remain sound for many years if a shallow gold foil filling (F′) is placed before caries penetrates deeply. Such a filling would not cut off the tubules leading to the incisal corner, and thus its resistance to fracture would be maintained.

Cavity forms vary, of course, depending on the filling material. In order to avoid complicated discussion, this variation has not been mentioned. This paper deals only with the fundamental fact that the cutting of the dental lymph supply affects cavity margins.

Fillings can be classified according to their subjection to the stress of mastication. If the occluding teeth strike the margins forcibly, these margins must be as firm as possible to resist fracture. If, on the other hand, the force of mastication does not affect them, the possibility of fracture is remote. Fillings of the latter type are used to repair the cervical areas of the teeth. However, there is another factor in cavity preparation for such fillings—the esthetic. Clinical observation shows that all marginal areas around fillings from which the dental lymph has been cut off become not only brittle, but also somewhat discolored. If, therefore, the operator wishes to take the appearance of a tooth into consideration, it is necessary to preserve the lymph supply of the marginal areas. This can be done by preparing the cavity walls, as nearly as possible, parallel to the direction of the dentinal tubules (Fig. 8, labial filling).

A fourth factor in cavity preparation is the histologic aspect of cavity form. The general trend of the dentinal tubules has been shown in Figures 6 to 9, explaining why they are cut off from the pulp by cavity preparation. It is clear that the more extensive the undercuts used in preparing cavities, the larger the area of marginal dentin and enamel cut off from its connection with the pulp. It is necessary to emphasize again that this statement applies particularly to recently erupted permanent teeth. An adult in middle life usually has teeth in which protective metamorphosis is well advanced and in which most of the crown dentin has been cut off from tubular connection with the pulp by the formation of secondary dentin. Fillings can be placed in such teeth, irrespective of the direction of the dentinal tubules. Likewise, the crowns of deciduous teeth are matured at the time when fillings are placed. (Fig. 3.) Here, too, the direction of the dentinal tubules need not be considered during operative procedures. The subject under present consideration is the mode of filling the permanent teeth of children and adolescents.

The discussion by the authorities on operative dentistry will center entirely around the question: Is a tooth harmed or benefited if the dental lymph is cut off from the marginal areas of fillings? From a histologic point of view, the answer to this question depends on (a) the age of the patient and (b) the degree of caries activity at the time of treatment.

(a) The tubular connection of the pulp with crowns of teeth of children and adolescents should be preserved as nearly as possible to maintain fracture-resistant margins. This refers particularly to those areas which are self-cleansing and, therefore, not so susceptible to further destruction by caries. The reason for this statement is that some investigators now believe that a recently erupted tooth, such as the first permanent molar in a child of 8 to 10 years, is not yet fully calcified. Hodge[5] and Karlstrom[6] have corroborated this belief by scientific hardness tests. The latter joins me in the belief that the mineral salts for the posteruptive hardening of the teeth originate from the pulp and not from the saliva. This hypothesis is substantiated by laboratory[7] observations showing that normal human enamel is impermeable to saliva. Clinical observations, too, sup-

port this hypothesis inasmuch as enamel margins around fillings placed in young teeth occasionally tend later to become bluish, transparent and liable to fracture.

Hence, it seems that pulps should be conserved, particularly in recently erupted teeth, in order to complete their posteruptive calcification.

(b) Whether a tooth is harmed or benefited when the dental lymph is cut off from the marginal areas of fillings is a matter of the degree of caries activity. In mouths of young persons in which caries is rampant, it seems beneficial to empty food retentive areas of dental lymph. This is particularly true if the areas are not subjected to heavy occlusal stress because of the tendency to reduce the activity of caries by this means. The reason for this statement, as already emphasized, is that the cutting off of the lymph supply decreases the permeability or porosity of these areas.

CONCLUSION

Let us summarize the effect of interfering with the lymph supply during cavity preparation:

The marginal areas of occlusal fillings in young persons, unless well protected against the stress of mastication, should have a cavity preparation which retains as much lymph as possible.

On the other hand, those marginal areas which are shielded from the force of mastication, as in cervical cavities, are in no danger of fracture through external forces; hence, the cutting off of the lymph supply would have no weakening effect. However, the esthetic factor is always present in dental reconstructions. As the cutting off of the dental lymph often results also in darkening of the marginal areas, even in cervical fillings, undercuts which tend to sever the lymph supply should be avoided as much as possible.

The debate which may be raised by this discussion of histologic data will revolve around the question: Is it more desirable to have enamel margins around fillings caries-resistant or fracture-resistant? And that is a subject for discussion by the authorities on operative dentistry.

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RACE DECLINE AND RACE REGENERATION

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PRESENT WORLD DILEMMAS

FOR a large part of the inhabitants of the world today, wars and rumors of wars will be considered the greatest threat to life in peace and happiness. The urge for the preservation of life and liberty, including a source of food supply, has dominated all human behavior. Fundamentally, wars have had their chief origin in a disregard for one of Nature's primary laws of life; namely, the necessity for maintaining a balance between population and the capacity of the soils to produce foods in adequate quantity and quality for supporting it. Modern methods of food production, including agriculture, are primarily adapted to maintaining and increasing the food supply.

While wars are threats that ebb and flow with the struggle for control of land and sea areas, a dilemma has often developed in a progressing severity that expresses itself in a decline of human physical qualities associated with mineral depletion of the soil. These are recognized primarily as individual and group degeneration.

Many modern students of human welfare have emphasized that a dire threat to the continued existence of our modern civilization is expressed in the increasing evidence of degeneration.

Carrel[1] has strongly emphasized the significance of the data indicating that modern man is delicate, and that while the number of deaths from infectious diseases is greatly diminished, man still must die in a much larger proportion from degenerative diseases.

Without quoting at length from many authors, each of us is familiar with the almost daily parade in the press of crime and degeneration. We of the dental profession are directly concerned that approximately four-fifths of the entire population of the United States receive no dental service and that the operations for those that do receive attention are primarily limited to repair and restoration. While the evidence is clear that the percentage of school children in our cities suffering from lost immunity to dental caries remains at approximately 100, a great mass of the population living in districts where the economic stress has been particularly severe have experienced an increase in the severity of dental caries. This is emphasized frequently in my correspondence. For example, a dentist in West Virginia has recently written as follows in discussing the question of increase in dental caries:

> I do general practice and caries is what I have to deal with the most of my time. I have had patients in the past few years as young as 14 years where both upper and lower teeth had to be extracted. I made a denture this week for a patient 19 years old. It seems to me the depression has produced a great increase.

Similarly, a dentist in Kansas has written:

> My patient is a boy about 15 years old. All of his teeth are through except the third molars and they are all decayed, a majority of them into the nerve. The only thing I can see to do is take them all out and make plates.

Read before the Section on Periodontia at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 12, 1940.

FAILURE OF REPAIR PROGRAMS

Man's habitats on the earth as established by Nature have provided controlling factors for the rise and fall of human quality, and a study of the reaction of the human species in various types of environments throws important light on the nature of the forces determining the level of physical excellence and mental and moral advancement. Nature has been maintaining a world-size biologic laboratory in which animal life, including human, has responded to the varying environments of the different locations. Whereas most of the previous deductions have been based on the premise that the controlling forces are not subject to influence, the new approach reveals that the whole process is a biologic one and that man is an expression of the reaction of his body to his environment. In other words, degeneration as well as acceleration are biologic processes.

Of the many cultural expressions of mankind in various parts of the world, a few racial stocks have persisted through tens of thousands of years, while others have risen and fallen in a limited number of centuries. The ability to persist has been largely an expression of that group's capacity to adapt itself to that part of the environment which could not be controlled. Our modern civilizations as expressed in various parts of the world today are primarily the expression of the accumulated wisdom of their tribes or groups in regard to their capacity to adapt themselves to their environment; in other words, to learn Nature's laws and have both the courage and the strength to obey them.

It is very important that in our efforts at evaluating our boasted modern civilization, we compare our culture with that of many other races of mankind, instead of thinking of culture as a progressive march of humankind up to its zenith of perfection as expressed in modern white civilization. We should think relatively. Fortunately, there is an important movement in this direction at the present time.

M. F. Ashley-Montagu, distinguished anatomist and anthropologist, has done this excellently in the June issue of *Scientific Monthly* under the title "The "Socio-Biology of Man." After asking what man is as a biologic being and what he is as a social being and discussing these considerations in detail, he traces man's development as expressed in many of the primitive races and emphasizes the importance of quality over quantity of knowledge or experience. He writes:

> In spite of our enormous technological advances we spiritually and as human beings are not the equal of the average Australian Aboriginal or the average Eskimo—we are very definitely their inferiors. We lisp noble ideals and noble sentiments—the Australians and the Eskimos practice them—they neither write books nor lecture about them. Theirs are the only true democracies, where every individual finds his happiness in catering to the happiness of the group, and where any one who in any way threatens the welfare of the group is dealt with as an abnormality.

The general approach to interpreting this phase of the problem has assumed that those individuals who suffer from contact with the European civilization have done so because of something that was added to the local environment and brought about by the foreign contact. Similarly, in the interpretation of physical degeneration among the white races, the basis of the interpretation has been that something like an infective process has been a chief factor in producing physical injuries as expressed in lowered organ function as modern degenerative disease. This has been the chief explanation for the diseases of the oral cavity which held that dental caries and the breakdown of alveolar tissues were primarily infective processes and that changes in facial and dental arch form were the result of faulty breathing habits, thumb sucking, etc. On this basis of approach, little advance has been made

in preventive procedures during the past hundred years. Because of evidence of universal failure, I have been impressed with the fact that our fundamental problems are related to the absence of essentials for maintaining physical normality rather than invasion of new forces such as infection.

In order to throw light on this phase of the problem, I have gone to fourteen primitive races in many parts of the world to study typical groups in various stages of modernization, from those that are primitive because of isolation and protection from modern influence to groups in various degrees of modernization through commerce with the white races. I have reported these various studies in articles and elsewhere.[2]

While I shall not review here in detail those findings, it is important in connection with this broad approach to the problem of race decline and race regeneration to emphasize briefly some of the outstanding findings in these field studies. Of particular significance is the fact that these various primitive racial stocks, though living in vastly different environments, ranging from the Arctic to equatorial jungles and from sea level to high mountain areas, the physical changes have not only been similar in each of these different locations when contact is made with modern civilization, but also, in many instances, the individuals have taken on the physical characteristics of the white race of Europe and America. This strongly emphasizes the similarity of the forces at work and their intensity, since the results have been similar in spite of all of the inherent resistance due to the long existence of those racial stocks in their particular environment.

The problems that relate directly to the oral cavity concern particularly the dental profession. Whereas the average incidence of dental caries in the isolated primitive groups regardless of location or tribal characteristics involved, on the average, is approximately one tooth per hundred teeth examined, within a relatively short time after contact was made with the white race, this factor increased to an average of thirty teeth of each hundred teeth. In many groups, the primitive stocks showed as few as one tooth per thousand teeth attacked by dental caries before the contact was made with modern civilization, and an increase for the highly modernized groups to 400 and even 600 per thousand. On the basis of individuals affected, the change in some of the groups was from only one in thirty having even one tooth that had been attacked by dental caries to nearly every individual in the group after modernization. Similarly, the health of the supporting tissues, as expressed in loosening of the teeth or so-called pyorrhea, often changed from a very high immunity to an exceedingly low immunity in a short time after a group had made contact with modern civilization. Particularly significant has been the fact that facial and dental arch form as well as body form often changed relatively quickly after the new contact was made.

Tribal facial and body patterns have been assigned by anthropologists to forces of heredity that are almost immutable and that would therefore prevent any rapid change in body pattern. Strikingly, in all of these primitive groups, these patterns changed rapidly in even the first generation after the parents had come sufficiently under the foreign influences. This strongly emphasized that the changes were not due to heredity. Figure 1, above, shows a father and son, both pure blood Indians, living on the coast of South America at Talara, an oil refinery town. The father was the product of the environment in which his parents lived before establishment of the refinery. Here, the International Oil company has a large staff of workers. They and their families live on the coast, where the refineries are located, a district which is arid. These Indians are descendants of the Chimu tribe, a culture

that has left a vast number of well preserved burials along that coast. The district between the Andes range and the coast has been almost completely rainless for thousands of years. Burials, accordingly, have been well preserved in the dry sand. In an examination of 1,276 skulls from the burials of this district, I did not find a single skull with typical deformity of the dental arches—not as much deformity as would be present in more than 25 per cent of Americans and Europeans of the highly modernized districts. The boy in Figure 1 represents a change in the development of the facial bones resulting in crowding of the teeth. The impact of a new force has completely prevented repetition in this new generation of the normal processes of heredity. To demonstrate that this is not purely a question related to the coast of Peru, Figure 1, below, shows a father and son representing a similar facial change in the high Andes. The forces that can divert normal transfer of ancestral patterns not only must be very great, but also must operate on the carriers of the architecture for facial and body pattern.

Fig. 1.—Disturbed heredity. The father is the product of the primitive nutrition. The son, also of full blood, is the product of foods of commerce used by the parents. Above, coastal Indians, Peru; below, high Andes Indians, Peru.

This problem of rapid change in racial types as expressed in facial design and body form is demonstrated in tens of thousands of our American homes by the difference in the architecture of American-born children of European parents throughout the entire United States. The new generation often knows that something has happened to make them different from their parents. A young woman of Italian parentage living in Cleveland came to me to ask why it was that the boys and girls in the Italian community in Cleveland were not so good looking as their parents. This problem is also emphasized in a large number of American and Canadian homes where there are several children in the family and is expressed as a greater change in the later born children than in the first born.

Figure 2 shows two boys, the one to the left the seventh child and the one to the right (two views) the eighth child, both of whom have marked narrowing of the face including narrowed dental arches.

Figure 2, right, shows the eighth child with his upper dental arch exposed to show its very marked narrowing and distortion. It is significant that this striking expression of modern degeneration in the white race under its present method of living apparently had not been appreciated or discovered until I found it occurring in even the first generation of the primitive races coming under the influence of the modern white race and its commerce.[2]

The forces that cause these changes are now demonstrated to be related to defects in the carriers of life of one or both parents, due to deficient nutrition prior to fertilization and, in some phases, to faulty diet of the mother during the formative period of the child. While deformities of the body, including the face and dental arches, have formerly been assigned to heredity through the mixing of racial blood and to faulty habits in the early growth period, these new data clearly relate much of this type of injury to defective germ cells. That it is not heredity is clearly demonstrated by the fact that by depriving female pigs of vitamin A for some weeks before mating and for thirty days after mating and then adding vitamin A liberally to the food, serious defects have already been

Fig. 2.—Progressive lowering of reproductive capacity of parents. At left, seventh child; middle and right, two views of eighth child.

established. Fifty-nine young from six pigs so treated were all born without eyeballs or optic nerves, in addition to which many of them had cleft-palate, harelip, club feet, spinal bifida and deformed ears. Four typically deformed pigs are shown in Figure 3: upper right, eyeless and deformed ears; upper left, cleft palate; lower right, spinal bifida, and lower left, harelip and cleft palate. In future litters from the same sows under favorable conditions of nutrition, there were no deformed offspring. Similarly, the offspring of matings between these blind and deformed pigs when on an adequate nutrition were entirely free from defects. This was also true of the offspring of one of the sows that had given birth to a litter of defective pigs. When she was mated with one of her own defective offspring, eleven normal pigs were produced. The latter condition, according to the laws of heredity, would have required that some defective offspring be produced.

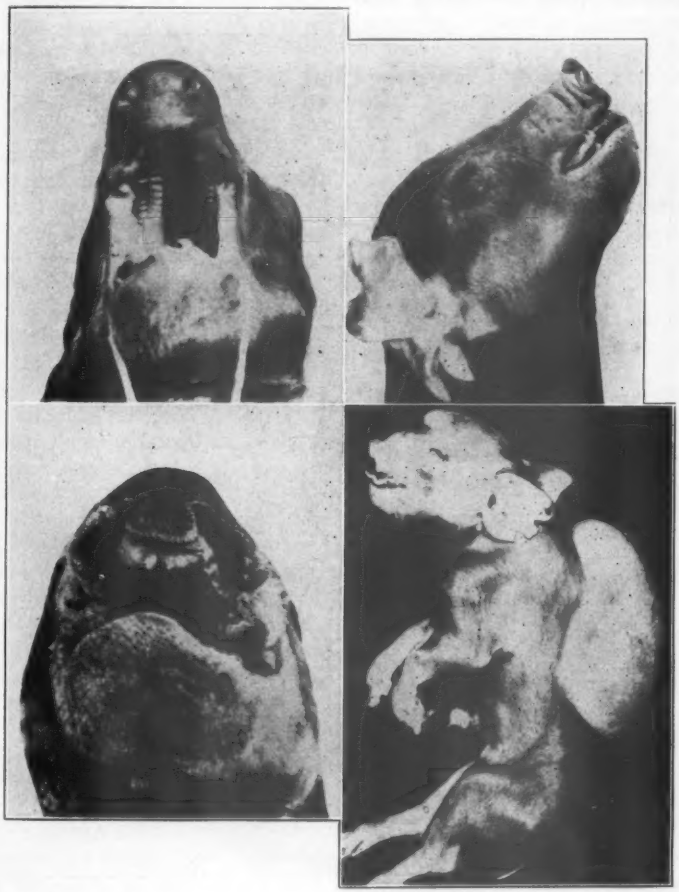

Fig. 3.—Gross defects due to vitamin A deficiency of female pigs before mating.

Similarly, I have the record of a fe-

male dog that has produced five litters, the first four litters by the same sire. In the first three litters, with both parents on an excellent diet, no deformed offspring were produced. In the fourth litter, the diets of both mother and sire were deficient in fat-soluble vitamins, particularly A. From this mating, there were ten pups, eight of which had cleft-palate. One had both harelip and cleft-palate and two were normal. In the fifth litter, this dog was mated to one of her own offspring, in which case, if there had been an hereditary basis for these defects, they should have appeared in the offspring, which were all perfect. In Figure 4 are shown three typical defects in dogs due to the nutritional deficiency of parents: upper left, cleft-palate; upper right, cleft-palate associated with spinal deformity shown below. That the responsibility may be related to either parent is established by the development of the two latter striking defects involving cleft-palate and spinal deformity in five pups in four litters born about the same time and all by the same sire.

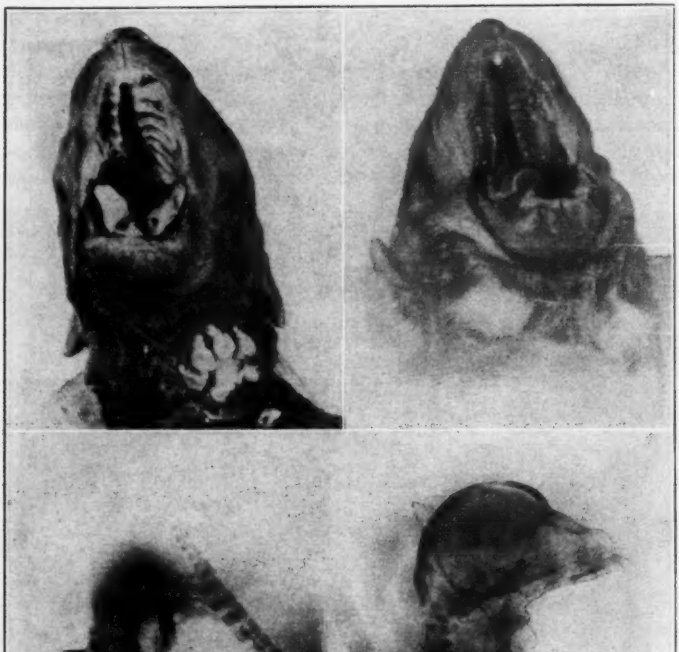

Fig. 4.—Gross defects due to vitamin deficiency of male dogs before mating.

It is of special importance for the

members of the dental profession that in various types of deformities, disturbed development of the facial bones, particularly the maxillary bones, was a common occurrence, tending to be present in association with most other defects.

A striking illustration of facial injury will be recognized in the faces of mongolian idiots. These have usually proved to be the last child in the family, born after the mother was 40 years of age. In this case, the mental injury associated with the physical is very conspicuous. The members of this group present a uniformly severe association of physical deformity and personality change due to brain defects. It is now recognized that we have a large group of border-line individuals with varying degrees of mental deficiency, usually spoken of as backward or retarded persons. It is of great importance that the members of this group quite regularly show either marked or moderate physical injury in the development of the bones of the skull, particularly the maxillary bones.

In the light of these new data developed from my studies among primitive races and from animal experimentation, there is strong evidence that these backward individuals are primarily the product of defective germ cells of one or both parents. It is a cause for great concern that these disturbed mental states frequently express themselves in such unsocial behavior that many of this group are conspicuous in their communities for delinquency in various forms. These character changes have been largely assigned to environmental influences due to frustration and disappointments of the child in the early growth period and therefore assigned entirely to the environment, with the result that the effort at their correction has been almost entirely limited to improvement in the social environment of the growing child. This procedure is apparently much too late for prevention of this expression of racial degeneration, which has a very widespread influence in our modern social organization, including group and national behavior. It is particularly tragic that whereas many of the primitive races studied have had practically no delinquency problems prior to their contact with the white race, serious problems have arisen with the processes of modernization. These severe expressions of group and racial deterioration constitute what is probably one of the most serious single problems confronting modern civilization.

Specialists in the study of the physical and mental characteristics of these delinquents have presented important data. Burt,[3] of London, after extended contact with juvenile delinquents, makes this comment:

> It is almost as though crime were some contagious disease, to which the constitutionally susceptible were suddenly exposed at puberty, or to which puberty left them peculiarly prone.

That there are predetermining conditions which relate to physical constitutions has been emphasized by Tredgold, whose extended studies led him to relate the problem to two sources of germ-cell injury, which he described as "germinal blight" and "arrest." He has stressed particularly that the former condition was pathologic and related to the germ of either or both parents, being due to poisoning of the germ cell. It is also important that Tredgold recognized the direct relationship between facial and dental arch development and mental deficiency. He says,[4] in discussing palate form:

> The association of abnormalities of the palate with mental deficiency has long been recognized, and there is no doubt that it is one of the commonest malformations occurring in this condition. Many years ago Langdon Down drew attention to the subject, and more recently Clouston has recorded a large number of observations which show conclusively that, although deformed palates occur in the normal, they are far and away

more frequent in neuropaths and mentally defective. He states that deformed palates are present in 19 per cent of the ordinary population, 33 per cent of the insane, 55 per cent of criminals, but in no less than 61 per cent of idiots. Petersen, who has made a most exhaustive study of this question, and has compiled an elaborate classification of the various anomalies, found palatal deformities present in no less than 82 per cent of aments (mental defectives), in 76 per cent of epileptics, and in 80 per cent of the insane.

Hickson, in the report of the Cook County Probation Officer, in 1914 states, regarding delinquents, that 85.8 per cent of females are distinctly feeble-minded and 84.5 per cent of boys under arrest are morons.

Hooton, in his investigation of criminals published in his book "Crime and the Man," after consolidating studies of 15,000 criminals in ten states, writes:

On the whole, the biological superiority of the civilian to the delinquent is quite as certain as his sociological superiority. . . . One set of consistent contrasts rears itself in a solid, unbroken, and towering front. The putatively law-abiding citizen, however humble his social and economic status, is largely superior in physique and in most anthropological characters, so far as judgments of quality can be made, to the White criminal of comparable ethnic and racial origin and drawn from approximately similar occupational levels.

Social workers and teachers are continually impressed with the evidence that we have an increasing number of backward boys and girls unable to carry forward their studies with their classmates, and with conspicuous unsocial traits. In many communities, field workers and clinicians are observing an increasing number of defectives. A teacher from the hill country of a neighboring state recently reported to me that a considerable number in her group of thirty children were unable to carry forward their studies. The children from one family strikingly illustrated the progressive decline in reproductive capacity of the parents. The youngest of the eight children has both harelip and cleft-palate; the seventh has cleft-palate; the sixth is retarded mentally, while the first born is normal.

This problem of capacity for efficient reproduction constitutes one of the most important confronting our declining modern white race.

The importance of the perfection of the germ cells is well expressed by Dr. Streeter, director of the Department of Embryology, Carnegie Institute at Washington:

It is well known that eggs, and by eggs I refer to fertilized ova, are not all of equal quality. In pigs and in man it is estimated that as many as 25 per cent of them are not good enough to be born as living individuals. . . . In man such specimens make up a large part of the material that the physician encounters as miscarriages. Nor is the importance of quality limited to uterine life. Whether the infant survives its first year and in fact a large number of them fail to do this depends in considerable part on the original quality of the egg. If they withstand the usual experiences of life until between 50 and 60 years old and then succumb to its aggregate wear and tear, they conform to the actuary's "expectation of life at birth," and to the embryologist's expectation of the performance of an egg of average quality. It is only the extraordinarily good egg that is still going strong at 80 years, and we see him (or her) do this in the absence of any exquisite hygienic regime or environmental favor.

RACE REGENERATION

Since the processes of race decline and race degeneration are clearly biologic and related to failure to meet Nature's requirements in the matter of nutrition, both that of the individual during the formative and growth periods and that of the parents-to-be before fertilization takes place, means are indicated whereby the correction of these errors may be achieved for the progressive betterment of the human stock.

Two distinct types of degeneration have been disclosed by my studies among

the primitive races. One has to do with the breakdown of the organs and tissues of the affected individual, whereby function is disturbed, and the other has to do with the architecture of the body and is related to the capacity of the germ cells to carry forward the unit characters that are provided for normal heredity.

A typical example in the first group is dental caries. The members of many of the primitive races, who, like their ancestors, have been almost completely free from dental caries, have developed caries in a relatively short period following the change of nutrition from that of the primitive stock to that provided by the commerce of the modern civilization, and have again quickly regained their immunity to caries on returning to the primitive diet. That the same condition has obtained in nearly all of the fourteen primitive races studied when they changed from their various native diets to the food of commerce is strong evidence that a controlling factor lies in the nutrition.

A chemical analysis of the primitive foods provided in the various native dietaries when compared with the foods of commerce has disclosed a much higher level of minerals and vitamins in the native foods, as selected in accordance with the accumulated wisdom of those tribes, than in the foods of commerce. We have hereby a means for the control of active dental caries through modification of the dietary by making it chemically equivalent to that of the primitive stocks.

An excellent illustration of the application of this principle is provided by the history of the Maori stock in New Zealand. The skulls of the native New Zealanders before the coming of the white race and at the time of its arrival showed that only one tooth per thousand teeth had been attacked by dental caries. My studies of the modernized Maori revealed that from 30 to 60 per cent of the teeth had been attacked by dental caries, or from 400 to 600 teeth per thousand teeth. The present Maori dietary is very similar to that of the whites of New Zealand. In contrast with the original high immunity of the natives to caries, the modern whites of New Zealand are credited by their own dentists with having the poorest teeth of all groups in the world.

The Hukerara Girls' School in Napier for native Maori girls had, as I have reported, a high incidence of dental caries in the student body when I visited the school in 1936. Dr. Tocker has undertaken to improve the conditions there by modifying the food selection for this group in accordance with a program that I have outlined for him. This included a liberal increase of sea foods and seeds as used by the original Maori. His report, recently made in the *New Zealand Dental Journal,* indicates a reduction in dental caries of 75 per cent since the establishment of the program. Another item of importance that he reports relates to a flu epidemic in which not one of the girls in this group under the nutritional program contracted the flu, whereas, in the Maori boys' school in the same vicinity, approximately half of the boys developed influenza. Similarly, diphtheria, which was epidemic, failed to attack any of the girls on this special dietary program.

My investigations have included the practical application of the data obtained from these studies among primitive races to the control of dental caries in our highly modernized whites. By reducing the energy sources, chiefly refined sugar and white flour products, and increasing the foods providing the minerals and vitamins in their natural form, tooth decay has been controlled for from 90 to 95 per cent of the individuals. The failure to establish complete immunity was limited to those persons who did not cooperate properly.

It is a common experience to have referred patients in whom all or nearly all

of the teeth have been attacked by dental caries and, with no other change in the program but a reinforcement of the diet, to have caries completely checked even without fillings.

Another serious affection involving the tissues of the mouth is related to the supporting structures and is commonly regarded as pyorrhea. My experience among several primitive races in various parts of the world has been that both the skulls of past members of their race and the living members while in isolation have healthy supporting structures of the teeth with little tendency toward pyorrhea. An important change occurs in all of these groups with the change from the native nutrition to the foods of commerce.

A critical examination of the foods as selected by these isolated groups indicates a high level of the vitamin B series. Patients suffering from pellagra in various parts of the world have as one of their outstanding symptoms the breakdown of the supporting tissues of the teeth characterized by swelling and bleeding of the gums and loosening of the teeth. This constitutes one of the early symptoms, but one of the most nearly universal and the severest. Pellagra has been shown to be directly due to an inadequate quantity of that vitamin B factor which is now recognized and produced synthetically as nicotinic acid. The breakdown of the alveolar tissues and membranes surrounding the teeth is directly due to deficiency of both fat-soluble and water-soluble vitamins. Reinforcement with foods rich in these, including the vitamin B series, is indicated. The continued use of nicotinic acid as a prophylactic procedure, however, is not advocated, as other factors are involved which are provided in natural foods.

Another important part of the training of the young life of primitive races has been the transfer from parent to child of information relative to efficient sources of nutrition for maintaining complete health. I have presented many illustrations of this in my reports.

If our modernized civilizations are to regain much that has been lost through failure to provide our bodies with an adequate amount of the essential food factors, the first requisite will be information in time to prevent the development of the structural changes and affections that are responsible for the expressions of our modern degeneration. The data that I have been collecting from the primitive races are immediately applicable for this purpose.

Owing to the many requests from universities, colleges, high schools, boards of education and uplift organizations for illustrative material, such as I have accumulated, for teaching purposes, I have developed a series of profusely illustrated lectures in very simple language adaptable for educational uses in lay and professional groups.

Since the efforts of health agencies, particularly of the medical and dental professions, have been devoted so largely in the past to treatment and repair after disease and dysfunction have been established in order to relieve pain and discomfort without stemming the tide of degeneration, it is clear that any program that is to be effective should go back to the sources and prevent the development of these affections.

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REPAIR OF FACIAL DEFECTS WITH PROSTHESIS USING A LATEX COMPOUND

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IN Dorland's "American Illustrated Medical Dictionary," the term "prosthesis" is defined as "the replacement of a missing part by an artificial one" or "an artificial part." Today, the prosthesis most widely used by man is the dental prosthesis. (Although the term "prosthetic dentistry" has by common usage come to designate removable types of partial or full dentures, if we would adhere to the full meaning of the term, "prosthetic dentistry" should include all branches of dental restorative work.) It is not, therefore, surprising to find that the dentist, because of his familiarity with the anatomy of the mouth and face, and because of his wide experience with the technic of manipulating various dental materials such as vulcanite, gold, silver, porcelain and the newer synthetic plastics, is frequently called on to make prosthetic restorations, not only in the mouth, but of the face as well. Such nonplastic reconstruction is usually carried out in collaboration with the plastic or oral surgeon, who, in many cases, gives the initial treatment preliminary to restoration by prosthesis. The benefits that can be derived from such joint effort were well demonstrated during the first World War, which caused a mutilation of thousands of faces that could not always be repaired with surgical procedures alone. In such cases, it was found that carefully planned prosthetic appliances, used either as an auxiliary to a surgical procedure or in place of plastic surgery, gave the patient a greater degree of satisfaction than he could have obtained from a surgical procedure alone.[1]

Extensive facial deformities resulting from malignant lesions, lupus, syphilis or other conditions can likewise be remedied by the judicial use of prostheses.[2, 3]

Generally speaking, the purpose of prosthetic restorations about the face and mouth may be: (1) esthetic, as in a case of restoration of a portion of an auricle or the nose; (2) functional, as in the case of repair of an acquired or congenital cleft palate by an obturator in order to improve speech, or (3) both esthetic and functional, as in a case of restoration of an entire nose and upper lip which improves the patient's appearance and his speech.

The following classification, modified from Olinger and Axt,[4] gives us a general idea of the field in which prosthetic restorative work in the mouth and on the face and other portions of the head may be useful:

I. Intra-oral restorations
  A. Maxillary
    1. Dental
    2. Alveolar
  B. Mandibular
    1. Dental
    2. Alveolar
    3. Mental region
  C. Palatal
    1. Hard palate

From the Mayo Foundation Museum of Hygiene and Medicine, The Mayo Clinic.

Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 12, 1940.

2. Soft palate

II. Extra-oral restorations
- A. Cranial
- B. Facial
  1. Orbital
     a. The eye
     b. The eye and cheek bone
  2. Aural
     a. The entire auricle
     b. Portion of the auricle
  3. Nasal
     a. Entire nose
     b. Tip of nose
     c. Ala of nose
     d. Bridge of nose

In the group of facial defects, the two most common types of deformities, aside from harelip and its complications, for which prosthetic restorations may be indicated are (1) partial or total loss of the nose and (2) partial or total loss or congenital absence of the auricle. Since this paper will deal only with prosthetic restorations of the nose and ear, the causes of such deformities are classified:

I. Causes of nasal defects
- A. Trauma
  1. Automobile and railroad accidents, and so forth
  2. Gunshot wounds
  3. Miscellaneous
- B. Pathologic change
  1. Malignant lesions
  2. Syphilis
  3. Lupus vulgaris
- C. Congenital deformity (rare)

II. Causes of aural defects
- A. Trauma
  1. Automobile and railroad accidents, and so forth
  2. Gunshot wounds
  3. Miscellaneous
- B. Pathologic change
- C. Congenital deformity
  1. Total absence of auricle
  2. Other anomalies

The most frequent cause of nasal defects is malignancy necessitating removal of the major portion of the organ; while in the aural group of defects, developmental failure and automobile accidents are the more common causes.

Correction of such defects by plastic surgical methods is always given first consideration, of course, because a skilful plastic surgeon today can rebuild a satisfactory nose by grafting over the mutilated region skin and flesh taken from some other part of the body. On the other hand, restoration by prosthetic methods is possible and can be very useful under the following conditions: (1) when the patient is advanced in age; (2) when the patient needs an immediate restoration in order to carry on his work after removal of a malignant area and before reconstruction by surgical means is advisable; (3) when the patient is unable to pay for hospitalization for the plastic operation, and (4) when a plastic operation is considered inadvisable because of the location or extent of the defect.

CHOICE OF MATERIAL

The main problem encountered in a prosthetic restoration about the face is the finding of a material which will meet certain requirements. For example, a restoration of this type, in order to be successful, must be made out of a material that is: (1) compatible with the tissue on which it is to rest, (2) soft and pliable like skin and flesh, (3) light in weight so that the problem of retention will be minimized, (4) not transparent or opaque, but translucent, (5) easily moldable, preferably in a plaster of Paris mold, (6) a poor conductor of heat, (7) not readily affected physically or chemically by sunlight, heat and cold, (8) easily duplicated by using the original mold, (9) inexpensive, (10) not likely to shrink too much in the process of molding and casting and (11) washable.

Two main groups of materials are used for this type of work: (1) rigid materials, such as vulcanite, metals and celluloid, and (2) flexible materials, such as

mixtures of gelatin and glycerin and rubber.

Vulcanite.—Dental vulcanite has been used extensively for prosthetic restorations about the mouth and face because it was one of the first dependable materials used by the dentist on a large scale. This material is compatible with the tissues, is not heavy, can be molded easily and is durable. Upham,[5] as early as 1901, and Baird,[6] Baker[7] and Ottofy,[8] in 1905, independently reported the use of vulcanite for restorations of the nose and ear. In more recent years, Kazanjian[1, 9] reported the successful use of this material. Vulcanite is especially suitable in cases in which it is necessary to make attachments from the artificial nose to some other type of prosthesis already being worn by the patient, such as a full upper denture or spectacles. Unfortunately, however, with vulcanite, it is not possible to obtain a lifelike appearance, since the material is hard and not translucent and has to be painted with suitable paint to make it resemble skin.

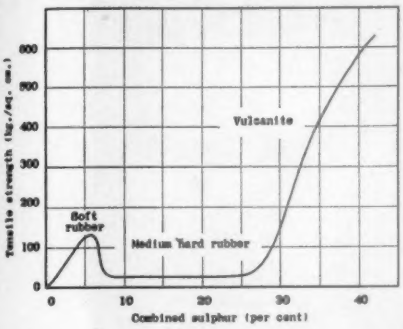

Fig. 1.—Tensile strength of vulcanized rubber obtained by various rubber-sulfur compounds. (After Skinner.)

Metals.—Shell-like reproductions of ears and noses made by electrodeposition of metals, such as gold, silver and copper, on a carefully modeled wax pattern of the missing part have also been used. According to Kazanjian,[9] this method was first introduced by Wood, was later adapted by Ladd and was used for the wounded French soldiers during the first World War. Axt,[10] and Olinger and Axt[4] more recently, reported the use of this technic in the restoration of an ear and a nose. There are several advantages in this type of prosthetic restoration: first is the fact that the reproduction can be made very light and, second, mechan-

Fig. 2.—Loss of entire right auricle. a, appearance of patient at time of admission. b, patient wearing prosthetic ear.

ical attachments for the purpose of retention can be soldered to various parts of the prosthesis. When gold is used for the surface which is to come in contact with the skin, there is no irritation. However, these metals, like vulcanite, are very stiff and opaque; therefore, they cannot be made to look like flesh. The prosthesis has to be painted to resemble the skin.

Celluloid.—Artificial noses made out of celluloid, shaped by pressing sheets of celluloid between a dye and the counter dye or by painting liquid celluloid into a mold, have been used with some success. This material is inflammable and is likely to warp on exposure to heat and cold.

Methyl Methacrylate. — Polymeric methyl methacrylate (acrylic resin), a

Fig. 3.—Loss of tip of nose. a, appearance of patient after operation. b, patient wearing prosthesis.

Fig. 4.—a, traumatic loss of entire right auricle. b, patient wearing prosthetic ear.

synthetic plastic, recently added to the list of dental materials on account of its translucent and durable quality, is a suitable substance for prosthetic restorations about the face when durability and strength are desired. Since the dye can be added to the material before curing, it does not have to be painted. Like vulcanite is has the disadvantage of being rigid.

Gelatin-Glycerin Mixture.—A new translucent material made from a mixture of gelatin and glycerin that showed great promise in simulating the skin in pliability and texture was introduced about 1913. According to Lederer,[11] credit for originating this material belongs to Warnekros and Klocke. According to Zinsser,[12] credit belongs to Hennig, who for the first time demonstrated

Fig. 5.—Loss of major portion of nose. a, appearance of patient after operation. b, prosthetic restoration.

Fig. 6.—a, loss of entire nose and upper lip owing to lupus. b, patient wearing prosthesis.

artificial noses made from this material at the Ninth Congress of the German Dermatological Society in Vienna. Hennig did not divulge the secrets of his formula. Zinsser,[12] however, soon after Hennig's demonstration of his material, published an article (1913) in which he described a material very similar to that of Hennig. This material was made by "incorporating 50 grams of gelatin (slightly moistened by water) with 100 grams of glycerin in a double boiler." Such a mixture can be poured into a plaster of Paris mold and, on congealing, becomes soft, rubbery and transparent. By adding to this mixture, before it is congealed, the correct amount of fillers, such as talcum or whiting, and coloring material, a fleshlike, translucent substance was obtained. This gave a far better esthetic result than had been obtained up to that time. In 1916, Zinsser[13] described in greater detail his technic of making molds and preparing the gelatin-glycerin mixture. One serious objection to this material is that although the esthetic results are good, prosthetic restorations made with it last only a few days or a week at the most.[14] Therefore, new noses had to be made constantly. Often, patients were supplied with the original mold and instructed to make their own duplicate casts. The gelatin-glycerin mixture, with slight modifications intended to lengthen the life of the material, was introduced, and its use reported by Bercowitsch[15] and Lederer[11] in 1928 and Batson[16] in 1935. Recently,

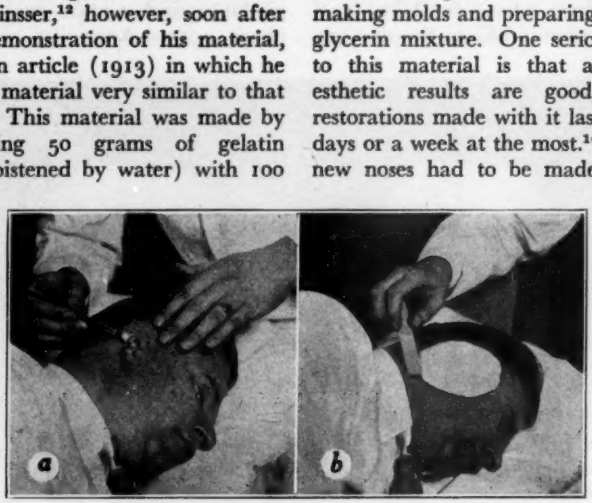

Fig. 7.—a, aural defect. b, extent of area included in taking plaster-of-Paris impression of defect.

Fig. 8.—Plaster of Paris impression. a, method of removing plaster-of-Paris impression from site of defect. b, comparison of impression with defect to determine whether it is free of imperfections.

Zinsser,[17] in another article on the use of gelatin for prosthesis, gave a summary of his experience in using this material for approximately 100 patients.

Vulcanized Latex.—The search for a material that would combine the durability of vulcanite and the translucency of the gelatin-glycerin mixture led me to experiment with various preparations made from latex early in 1935.[18] It seemed to me that if the technical difficulties of molding or casting a nose or an ear out of flexible rubber to correct color, form and translucency could be overcome, the material would be suitable for prosthetic restorations about the face. The need for a better type of prosthesis was called to my attention by Dr. New, head of the Section on Laryngology, Oral and Plastic Surgery of the Mayo Clinic, who showed much interest in the development of the work and made valuable suggestions.

During the last five years, I have used, with success, a compound made from prevulcanized latex. In two earlier papers, [18, 19] preliminary reports concerning the application of this material to prosthetic restorative work were made.

In order to understand the behavior and method of manipulation of latex, I shall review briefly the source and chemical and physical properties of this material and its various derivatives.

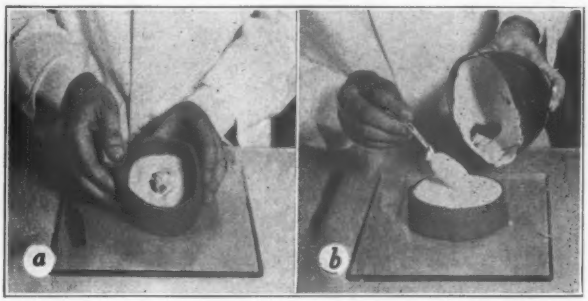

Fig. 9.—a, method of applying clay retaining wall around periphery of impression preliminary to pouring hard dental plaster. b, impression filled with hard dental plaster.

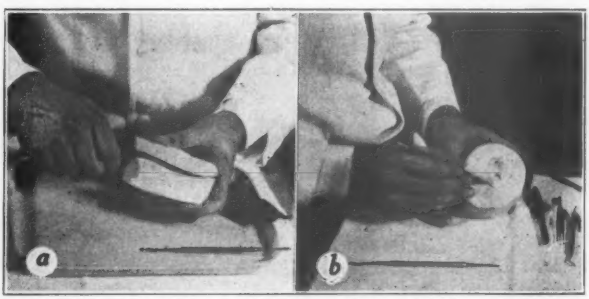

Fig. 10.—a, preliminary stage of separating cast from impression. b, marking outline of portion of prosthesis which is in contact with skin.

Latex and Vulcanization of Latex.—The basic raw material from which all natural rubber products, whether hard dental vulcanite or soft and pliable rubber, are made is latex, the milky exudate obtained from certain plants. The trop-

ical tree *Hevea brasiliensis* is the source of nearly all commercial latex today.[20] In the days before much was known about the chemistry of rubber, the use of latex was a hit-or-miss affair. Products made from it became gummy in hot weather and brittle and cracked in cold weather. It was not until the discovery of the principle of vulcanization in 1839 by Goodrich that articles made from latex became practical for daily use.

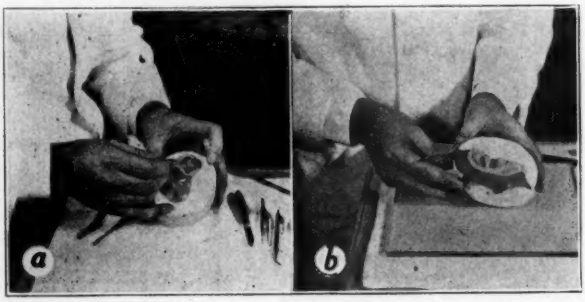

Fig. 11.—a, preliminary stage of adapting rough wax pattern of ear on cast. b, step in method of dividing wax model of ear into sections for making piece mold.

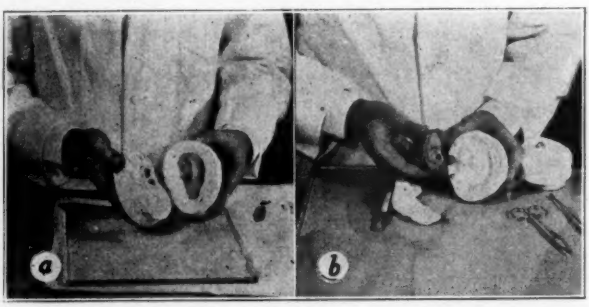

Fig. 12.—a, completed mold being separated preliminary to removal of wax pattern. b, prosthetic ear as it comes from mold.

Vulcanization is, as you know, the process of subjecting a mixture of coagulated latex and sulfur to high temperatures and thus producing a material of great strength and durability. In the case of vulcanizing dental rubber, the temperature employed is as high as 400° C. The latex-sulfur ratio is the factor which determines the elasticity of the vulcanized latex. Generally speaking, the lower the sulfur content, the softer the resulting vulcanized rubber, and vice versa. Figure 1, from Skinner,[20] gives a more accurate picture of what actually takes place when various proportions of latex and sulfur are combined during vulcanization. It will be noted that the maximal strength for soft elastic rubber is reached at approximately 5 per cent sulfur. The tensile strength decreases and remains low when from 6 to 25 per cent of sulfur is used. When sulfur in excess of 26 per cent is used, the tensile strength again increases.

According to Noble,[21] prior to 1920, before much was known about the preservation of fresh latex, latex was precipitated by weak acids and dried in sheet forms on the rubber plantation and

shipped to various parts of the world for subsequent treatment by milling and final vulcanization by the high temperature process. However, since the discovery that fresh uncoagulated latex can be kept in its original liquid form under proper conditions for months or years, by the addition of a preservative such as ammonia, the problem of transportation of liquid latex from the plantation to the various manufacturing plants has been greatly simplified. It has meant, therefore, that manufacturers of rubber goods can now obtain the uncoagulated latex in liquid form and do their own compounding and molding before vulcanization. It also has meant, in the manufacture of certain articles, the elimination of the cumbersome milling process, which was necessary in order to incorporate the vulcanizing agent (sulfur) with it preliminary to vulcanization.

More recently, the discovery of another highly important vulcanization process simplified the manipulation of latex still more. Rubber chemists are now able to "prevulcanize" latex. "Prevulcanized" latex resembles ordinary preserved latex, but chemically it is vulcanized latex, because, on drying and without further heat treatment, and unlike pure latex, it exhibits all the essential qualities of the rubber that is obtained by a more cumbersome method of vulcanization by heat treatment. This feat is accomplished by vulcanizing the individual particles of the pure liquid latex under carefully controlled conditions in such a way that the original physical form (liquid) of the latex remains unchanged during the process, continuing as long as it is kept in a closed container in a cool place. It is in this form ready to be used when needed.

This highly ingenious process of treating latex has made it possible to obtain a rubber in liquid form that can be poured into a mold or forms dipped into

EVALUATION* OF THE ESSENTIAL QUALITIES OF THE PRINCIPAL MATERIALS THAT HAVE BEEN USED FOR PROSTHETIC RESTORATIONS ABOUT THE FACE

Material	Compatibility with Tissue	Softness and Pliability	Lightness	Translucency	Ease of Molding or Casting	Nonconductivity of Heat	Chemical and Physical Stability	Ease of Duplication	Low Cost of Material	Lack of Shrinkage During Casting or Molding	Total Evaluation
Vulcanite	4*	0*	2*	0	3*	4	5*	2	4	4	28
Metals, gold, silver, copper (shells)	4	0	5	0	2	1*	5	1	3	5	26
Celluloid (shells)	4	0	5	3	2	4	2	3	5	5	33
Gelatin-glycerin mixture	4	3	3	4	4	4	1	4	5	4	36
Methyl methacrylate	5	0	3	4	4	4	5	3	4	5	36
Vulcanized latex compound	4	5	5	5	5	5	4	5	4	3	44

*0, none; 1, very poor; 2, poor; 3, fair; 4, good; 5, excellent.

it, and, on drying in temperature as low as room temperatures, the liquid rubber is converted into a highly elastic, soft and pliable rubber. The possibilities of such a useful material for application to prosthetic restorations about the face can hardly be overlooked. The material is compatible with the tissues; it is soft and pliable; it can be made light and translucent; it can be cast easily in a plaster of Paris mold; it is a poor conductor of heat, and it is not expensive. The slight degree of shrinkage that takes place during vulcanization is not so serious as might be supposed because this shrinkage can be taken care of by allowance for it in preparation of the wax pattern or by carving out certain portions of the finished plaster of Paris mold, thus making it possible for the cast to be that much larger in those parts. Furthermore, the fact that the material is elastic will minimize to some degree the effect produced by shrinkage.

The essential qualities of the various materials are summarized in the accompanying table.

Before I describe the technic employed in making these restorations of latex, I shall present several illustrative cases.

REPORT OF CASES

CASE 1.—A man, aged 25, lost the entire right auricle in an automobile accident May 5, 1940. He came to the Mayo Clinic August 5, for construction of a substitute for the missing ear. Figure 2, a, shows the site of the defect. It will be noted that the external auditory meatus is not closed over. This is a favorable condition from the standpoint of prosthesis. Figure 2, b, shows the appearance of the patient with the prosthesis in place.

CASE 2.—A man, aged 45, came to the clinic in March 1937 on account of a basal-cell epithelioma of the tip of the nose which had recurred after irradiation. March 16, 1937, the lesion was cauterized by Dr. New, this procedure resulting in production of the defect shown in Figure 3, a. July 7, the patient was referred to me for a prosthesis. The result of the restoration is shown in Figure 3, b. The surgeon in the case wished to observe the patient's condition to see whether the malignant lesion would recur, before instituting plastic repair. With the prosthesis, the patient is able to carry on his work until plastic surgery is considered advisable.

CASE 3.—A man, aged 38, had lost the entire right auricle in an automobile accident twenty-two years previously. In June 1940, he decided to have a prosthetic restoration made. This was completed July 1 (Fig. 4, a and b). The patient stated that with the artificial ear in position, his ability to localize the origin of sounds, such as train whistles and automobile horns, was greatly improved. This was verified by use of an audiometer.

CASE 4.—A woman, aged 39, lost the major portion of the nose on account of a squamous-cell epithelioma which appeared on the right ala and tip of the nose. (Fig. 5, a.) Total rhinoplasty, using a forehead flap to restore the nose, was decided on, but it was necessary to wait a year at least before this surgical procedure could be started. In the meantime, the patient was supplied with an artificial nose. (Fig. 5, b.)

CASE 5.—A woman, aged 64, had suffered extensive loss of tissue from a squamous-cell epithelioma, grade 3. The age of the patient and the extent of destruction made it inadvisable to reconstruct the lost tissue by a plastic surgical method. Therefore, a prosthetic appliance, reproducing the nose, part of the cheek and part of the upper lip, was made, being worn with some degree of success. (Fig. 6, a and b.)

DESCRIPTION OF TECHNIC

The important steps of the technic which is used in making a prosthetic restoration for the total loss of the ear or nose with latex compound are as follows:

Taking the Impression of the Region Involved.—For this step, there are three types of materials available. 1. Ordinary quick-setting dental plaster, the variety used in taking impressions in the mouth, is suitable for surfaces free of undercuts. 2. An elastic hydrocolloidal impression material, such as "negacoll" or "dentocoll," may be employed if the region

contains many undercuts. 3. A soluble type of plaster of Paris is preferred in taking impressions of regions in which undercuts are present because there is no danger of distortion with this material and because most tissues containing undercuts will allow the impression to be easily withdrawn. The subsequent cast can be separated from the impression by partially chipping off the impression and dissolving the remainder in boiling hot water. In Figure 7, a, preparations for taking an impression with a soluble type of plaster of Paris, preliminary to prosthetic restoration of the right ear, are shown. Regardless of the type of material used for the impression, it should include an area at least an inch (2.5 cm.) beyond the periphery of the proposed artificial ear. (Figs. 7, b, 8, a and b.)

The Cast.—After a satisfactory impression of the region has been taken, the next step is to obtain an accurate cast from the impression. A plaster-of-Paris impression, if used, is first painted with a thin coat of shellac or a similar separating medium. Then a clay dam is built around the impression (Fig. 9, a) and a mixture of hard-setting dental plaster is poured in. (Fig. 9, b.) The cast is separated from the impression after twelve hours. (Fig. 10, a.) It is important that this cast be accurate because later this will become part of the mold from which the final latex prosthesis will be cast.

The Wax Pattern.—The cast is studied carefully and on it is marked with pencil the limits of the margins of that part of the prosthesis that will come in contact with the skin. (Fig. 10, b.) Next, a roughly modeled wax pattern is placed over the cast and the periphery of the contact surface made to conform to the pencil marks made previously. (Fig. 11, a.) If the prosthesis is to be an ear, a cast of the opposite ear is made and its image in the mirror is used as a guide in making the wax pattern. The work of modeling an ear can be expedited by adapting a wax cast of another person's ear having a similar general shape. When work is being done on a nose, a photograph of the patient before the loss of the nose if available is used as a guide. The wax pattern must be made somewhat larger than desired to allow for the subsequent shrinkage produced when it is cast in prevulcanized latex. In making the pattern of the ear, the most difficult task is to conceal the line of juncture of the anterior portion of the prosthesis and the skin. A straight line at this region is least desirable. On the anterior side, if the tragus is normal, an attempt must be made to bring the line of junction at this point on the posterior, inner surface of the tragus. On the posterior side, the line of juncture is usually not noticeable because of its hidden position.

Trying the Wax Pattern on the Patient's Face.—This is done to determine whether the pattern is of correct size and proportions and whether it fits well, looks well and presents a symmetrical outline as viewed from various angles. During this preliminary trial, it is advisable to study points which on shrinkage, following vulcanization of rubber, may cause difficulty in fitting, and allow for such shrinkage by carving the corresponding points in the mold. The anatomic configuration of the back of the ear is a feature which must be faithfully reproduced. The outline presented by the artificial ear and the natural ear must be symmetrical.

Completing the Mold.—The wax pattern, after it has been tried on and found to harmonize with the face and present a satisfactory outline, is placed back on the original cast. In the case of an ear, a three-piece mold of the wax pattern must be made. This will make it easy to remove the final rubber prosthesis from the mold. The original cast in this case will constitute the lower part of the three-piece mold. A step in the making of the remaining two pieces is shown in Figure 11, b.

Removal of Wax Pattern and Final Preparation of Mold.—After completion of the mold, the wax pattern is removed by immersing the entire mold in hot water and then prying it open. (Fig. 12, a.) A funnel-shaped opening leading into the interior of the mold is made to permit pouring the latex compound. Selection of the site of this opening must be in accord with the peculiarities of the mold. Usually, it is best to make it on the lower part of the original cast. Before use, the plaster of Paris mold is allowed to dry for twenty-four hours.

Preparing the Prevulcanized Latex Compound for Pouring.—Three essential ingredients are used in making this compound, which is then poured into the plaster of Paris mold. The main ingredient is pure prevulcanized liquid latex. This material, on vulcanization, has a very transparent appearance, which is not suitable for the work. This condition is remedied by the addition of zinc oxide, the second ingredient. The third ingredient is the dye, which is added to the mixture to give the final product the desired color. The manner of incorporating the prevulcanized latex, the zinc oxide and the dye solution may vary according to the individual workers. It is preferable to incorporate the zinc oxide and the prevulcanized latex as needed in small quantities, because the presence of zinc oxide in such quantities in the latex has a tendency to gel the latex and make it unsuitable for pouring operations. The solution of dye is added in units of drops to a given quantity of the latex zinc oxide mixture. With a little experience, the amount of dye of known concentration to be used for a given quantity of latex to obtain the desired flesh tint will soon be determined.

The following method has been found to be an easy and practical way of preparing the compound for use as needed. It is given merely as a suggestion. Requirement of each case must be met by varying this basic formula to obtain the best match of color between the prosthesis and the adjacent skin. Two stock solutions are prepared. 1. Stock solution "A" is made by incorporating 3 gm. of zinc oxide, which has been thoroughly mixed previously in 5 cc. of distilled water, in 200 gm. of prevulcanized latex (Vultex). 2. Stock solution "B" is the dye. It is made by incorporating 1 gm. of Biebrich scarlet in 120 cc. of distilled water. To 50 cc. of stock solution "A" 2 drops of stock solution "B" is added and the two are mixed thoroughly and poured into the mold, which is placed in an oven regulated to stay between 60° and 70° C. Vulcanization will be completed at the end of from twenty-four to forty-eight hours, the time depending on the thickness of the prosthesis.

Trimming the Edges of the Prosthesis.—After completion of vulcanization, the mold is opened carefully and the completed prosthetic ear is removed from it (Fig. 12, b), and the edges are carefully trimmed with a pair of scissors.

Retention of the Artificial Appliance.—The problem of retention varies, depending on the type of restoration. This problem must be studied carefully beforehand and provisions necessary for added retention be made on the cast. The surgical liquid adhesive, known as mastisol, is made up as follows: 15½ ounces (439.4 gm.) of gum mastic; 24¼ ounces (735 cc.) of benzene; 176 drops (11.7 cc.) of oil of wintergreen, and 294 grains (19.1 gm.) of styrax. The benzene in mastisol, however, is somewhat injurious to the rubber. This deficiency can be eliminated by substituting choloroform for benzene in the formula. A simple formula for liquid adhesive can be made by dissolving 50 gm. of gum mastic in 100 cc. of chloroform. The patient must be instructed very carefully concerning the use of the liquid adhesive and the method of applying the prosthesis to the face. The importance of keeping the fine edges of the prosthesis clean and free of any ad-

hesive must be emphasized in instructions to the patient.

COMMENT

The success of a prosthetic restoration about the face will depend on three factors: (1) location, size and shape of the defect and the effect these will have on the problem of esthetics and retention; (2) careful planning of the prosthesis and attention to all details of the steps involved in the restoration, and (3) the patient's ability to use the prosthesis and his willingness to cooperate. The false stigma associated with the wearing of artificial restorations must be overcome.

If, with the aid of the prosthesis, the patient is made to feel that his appearance is normal again, and that he can meet his fellowmen without the constant fear of being gaped at, and if, with the aid of the prosthesis, he is able to readjust himself to his daily work, the prosthesis can be considered a success.

It is often gratifying and encouraging to find that although some patients at first seem to feel unnatural while wearing the prosthesis, they soon become accustomed to it and feel unnatural without it.

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INTRA-ORAL CARCINOMA: PRACTICAL CONSIDERATIONS IN REGARD TO DIAGNOSIS AND TREATMENT

By Lester Hollander, M.D., Pittsburgh, Pa.; Joseph M. Shelton, M.D., Washington, Pa., and Leo Shonfield, D.D.S., Pittsburgh, Pa.

SUFFICIENT progress has been made in the treatment of intra-oral carcinoma since the introduction of the contact type of roentgen-ray modality and the adaptation of refrigeration that a brief review of this subject may prove of value.

ESTABLISHMENT OF THE DIAGNOSIS

Carcinoma may affect any portion of the soft tissues within the oral cavity. As a general rule, it begins at the site of a previously present anatomic defect. Such a defect may be an ulcer, manifesting itself as an area of localized dissolution in the continuity of the mucous membrane, or a scar, replacement tissue either resulting from trauma or being the end-result of a previous destructive inflammatory process; or an area of leukoplakia, frequently the result of the use of tobacco, and known as a smoker's patch, or an aberrant sebaceous gland (Fordyce's disease) or an ordinary wart. These anatomic defects may still be demonstrable, especially before the neoplasm reaches a sufficient size to destroy them.

Most patients affected with carcinoma of the oral cavity suffer from poor oral hygiene, unless they are edentulous. Usually, the teeth give evidence of lack of care. They are discolored, tartar covered, broken, ragged edged, jagged or abraded or sharply faceted, easily causing damage to the buccal mucosa or tongue. The site so damaged may become the area of neoplastic involvement. The teeth are usually in various stages of decay and frequently bathed in a purulent exudate. The gingiva itself is frequently hyperemic and spongy, bleeding readily from the slightest trauma. The tongue is frequently heavily coated. Deep crevices form between the papillae and become packed with decaying food particles, sufficient irritation resulting to cause a chronic superficial glossitis. All of these conditions tend to accentuate the offensive odor which emanates from the decaying parts of the carcinoma.

Most of the patients are habitual users of tobacco, smoking or chewing it, either practice adding to the above-described unsanitary condition of the mouth. Most of the patients also habitually eat hot food—coffee, soup, etc.

To put into words our observations, as a matter of record, not in the form of a conclusion: Many patients suffering from intra-oral carcinoma are to be found in a familially susceptible group of individuals, in whom some preexisting mucous membrane defect is the subject of repeatedly recurrent irritation produced by tobacco or hot food, or from trauma from natural or artificial teeth or from adjacent microbic irritation, either as single or as multiple factors.

Carcinoma of the intra-oral cavity varies in appearance at different locations. On the buccal mucosa, it is found

From the Pittsburgh Skin and Cancer Foundation.

usually in one of two locations, on the interdental line or at the angle of the mouth. It usually appears amid a white, macerated, glistening plaque of leukoplakia, a portion of which is breaking down to form an ulcer, or as an area of tumefaction composed of firm neoplastic nodules. At times, most of the fan-shaped leukoplakia is covered by a grayish white warty growth which is found to be invading the underlying structures on almost the first examination.

As growth and destruction are associated in the development of the neoplasm, the appearance of an advanced tumor will depend on which one of the two processes is more rapid in evolution. When fully developed, a foul smelling deeply invasive tumor is found, having tell-tale marks of injury caused by its pressing against the apposing teeth, especially during mastication. It is noteworthy that pain develops slowly and that a degree of trauma occasioned by repeated biting of the tumor tissue frequently occurs without subjective symptoms. It is also noteworthy that all these changes frequently occur at the site where pipe stems or wads of tobacco are habitually carried.

On the gingiva, carcinoma develops frequently in areas marked by chronic inflammation and about teeth that are broken and decayed and below the occlusal plane of the adjoining teeth. The neoplasm grows about and envelops them.

Fig. 1.—Carcinoma of buccal mucosa. The teeth are frequently found to be bathed in pus.

Fig. 2.—Carcinoma of buccal mucosa; showing oral sepsis and lymph node involvement.

Fig. 3.—Leukoplakia or smoker's patch developing into carcinoma of buccal mucosa.

Fig. 4.—Carcinoma of buccal mucosa; showing leukoplakia.

The oral sepsis associated with it is usually appalling.

On the hard and the soft palate, carcinoma occurs as a rounded or elongated area of protuberance with ulceration. The hard plaster-of-Paris like quality of these tumors is an outstanding characteristic, as is the invasive quality, which soon causes sufficient destruction of the palatal structures to produce perforation. As a general rule, these tumors are not painful, apparently caus-

ing little inconvenience until such time as the perforations become extensive.

The anterior pillars of the tonsillar fossa are frequent sites of intra-oral carcinoma. They appear as highly cellular masses, soon becoming fungating because of their rapid and luxuriant growth. Hardness and fetidity are the dominant characteristics of these tumors.

Carcinoma on the floor of the mouth appears either as a small warty whitish growth or as an ulceration, either of which is very friable and bleeds readily. They develop into large ulcerative tumors, which invade the sublingual glands and metastasize early.

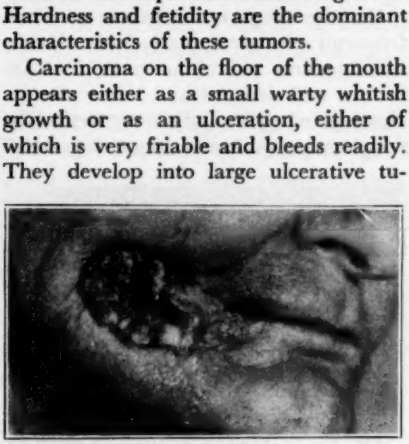

Fig. 5.—Carcinoma of buccal mucosa with perforation.

Fig. 6.—Carcinoma of floor of mouth; showing tumor pushing teeth out of alinement.

Carcinoma of the tongue may occur at almost any of its portions. At its margins, we frequently find it arising at the site of damage caused by a sharp or jagged tooth or where an ill-fitting or loose denture traumatizes it. Within the body of the tongue, it may arise in the scar tissue produced by a syphilitic interstitial glossitis. As in most other areas, at its beginning it is painless. The first noticeable symptom is restriction of the mobility of this strongly muscular and motile organ. Soon, on account of the binding down of the involved area, another early symptom develops, a one-sided traction noticeable on protrusion of the tongue. The traction is toward the affected side.

Carcinoma of the tongue appears either as a nodular growth or, at times, as a sclerosing process, pulling the tissues of the tongue together and giving it a shriveled fibrosed appearance. In either instance, the hardness of the affected area, the interference with the motility of the tongue, the difficulties experienced during mastication and speaking and the

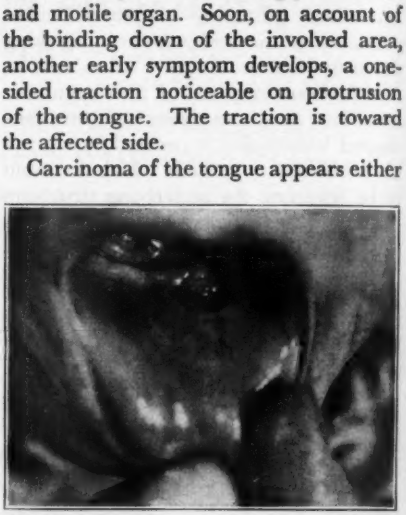

Fig. 7.—Carcinoma of lower alveolar ridge developing at area of ulceration and caused by wearing of ill-fitting denture.

Fig. 8.—Carcinoma of lower alveolar ridge; showing tumefaction.

progressive pain and tenderness will mark the development of the tumor.

Intra-oral carcinoma in most instances is composed of prickle or squamous cells, and it is so named. At times, it is also referred to as the epidermoid variety. It is the type of neoplasm which is highly malignant and which, with the exception of palatal carcinoma, metastasizes readily through the regional lymphatics. Thus, adenopathy appears in the submaxillary, sublingual, submental and cervical areas, the site depending on the region affected within the mouth.

Fig. 9.—Carcinoma of lower alveolar ridge invading ramus; showing friable character.

Fig. 10.—Carcinoma of upper alveolar ridge invading superficial maxilla and antrum.

STUDY OF THE PATIENT

1. Examination of intra-oral lesions is greatly facilitated by the use of two tongue blades instead of the customary one, permitting wider exposure of the oral cavity.

2. A portion of the tumor, preferably a protruding part, is snared off (guillotined) for microscopic examination.

3. A thorough examination of the teeth is made by a dental surgeon, including a roentgen-ray search for residual infection and retained roots.

4. A careful medical history, including the habits of the patient and a searching family history to ascertain any occurrence of cancer, together with a meticulous general physical examination, is carried out.

Fig. 11.—Carcinoma of anterior tonsillar pillar.

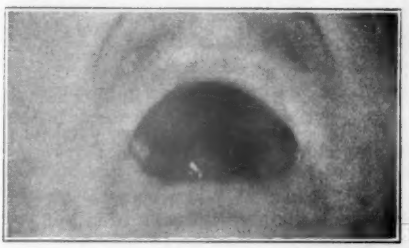

Fig. 12.—Carcinoma of hard palate.

5. A clinical laboratory study of the blood picture and serologic tests complete the necessary data.

TREATMENT

1. The use of tobacco is prohibited.

Tobacco is a mucous membrane irritant although its rôle as a carcinogenic agent has not been definitely determined. It would not be reasonable to consider it as such *per se,* for there are millions of tobacco users, while the victims of intraoral cancer are relatively few. It is, however, not unreasonable to suppose that given the proper soil and the right kind of inheritance, any chronic irritation will result in carcinoma formation. The rôle of tobacco as an irritating epidermal agent has been more thoroughly appreciated since the recent publication

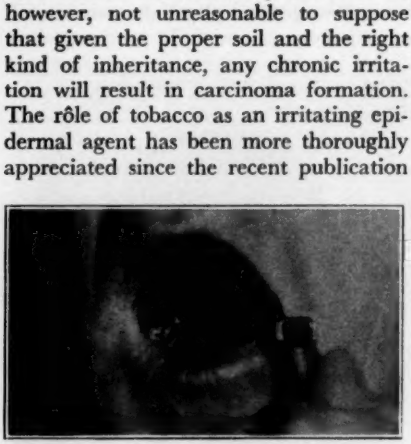

Fig. 13.—Carcinoma of hard and soft palate with perforation.

Fig. 14.—Carcinoma of tongue developing in area of chronic glossitis damaged by ill-fitting dentures.

of Barksdale,[1] which calls attention to the appreciable amount of arsenic found in the finished product, whether used for smoking or for chewing. The presence of arsenic is accounted for by the sprays used during cultivation. Again, it has been long known that arsenic is a potent epidermal irritant, as evidenced by the formation of multiple palmar and plantar keratoses, which frequently undergo malignant changes, in those individuals who have had to ingest arsenic over a long period of time. The rôle of arsenic in tobacco as a carcinogenic agent needs further and extensive investigation.

A recent interesting article by Goeckerman and Wilhelm[2] concerns a patient who had taken arsenic over a period of

Fig. 15.—Carcinoma of tongue developing in interstitial chronic syphilitic glossitis.

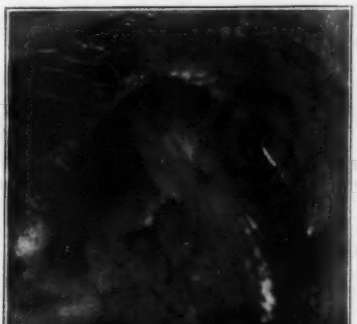

Fig. 16.—Unusual form of carcinoma of tongue developing in interstitial chronic syphilitic glossitis.

ten years. Not only did typical arsenical keratoses of the extremities develop, but also carcinoma of the bladder and ureter. These growths were found microscopically to contain large amounts of arsenic.

2. The use of hot food, especially hot coffee and soups, is prohibited.

3. The chewing of rough substances capable of mechanical damage, such as chicken bones is prohibited.

4. The wearing of artificial dentures is prohibited.

5. Oral sepsis is reduced. As a general rule, patients suffering from intra-oral carcinoma have developed bad habits in regard to their own mouth care. Considerable persuasion and meticulous dental care will be needed to alter this situation. Broken, jagged, devitalized teeth and those presenting extensive root infections should be extracted. The sharp edges should be removed. Excessive tartar should be scaled off. Peridental infections, gingival stomatitis and Vin-

Fig. 17.—Carcinoma of tongue; showing lymph node involvement.

cent's infection should be treated, the last in the mildest fashion; i.e., the patient is instructed to prepare a weak solution of sodium perborate, one teaspoonful to a tumbler of water, and to use this as a mouth rinse five or six times a day. After three or four days, the strength of this mouth rinse is increased, and if the oral mucosa is not irritated by it, the procedure is changed to gentle massage with the powder (sodium perborate) itself on the moistened index finger of the patient. It is important to follow this massage by thorough rinsing of the mouth. We object strenuously to the use of harsh methods and strong antiseptics in the reestablishment of oral hygiene, especially in the presence of marked oral sepsis. It can cause no benefit and can only result in further damage.

6. As a general measure to improve oral hygiene, the patient is instructed to take the mixed juice of one lemon and three oranges and 6,000 units of vitamin B_1, in addition to all other food consumed each day.

7. Since the important contribution of Temple Fay and Lawrence Smith concerning the use of refrigeration in the treatment of carcinoma in general, we have added this procedure to our therapeutic armamentarium in the local treatment of carcinoma within the oral cav-

Fig. 18.—Carcinoma of tongue in syphilitic.

ity. The supposition of the two experimenters is that freezing affects the growth of carcinoma cells more adversely than that of normal cells because the former are less mature and thus less developed, and if freezing can be sufficiently prolonged, the developemnt of the carcinoma will be retarded and, in some instances, may even be stopped.

We have accepted this therapeutic principle as sound and have adapted it to the treatment of intra-oral carcinoma. In order to carry it out properly and as nearly continuously as possible, the patients are kept under nursing supervision for three or four days, during which time ice cubes of suitable size are kept against the lesion during the entire waking period of the day except at mealtime.

When the patient understands the procedure thoroughly, he is instructed to continue it at home for eight or ten weeks.

8. No procedure, with the exception of radiotherapy in the form of topical application, is of greater importance in the treatment of intra-oral carcinoma than so-called contact roentgen-ray treatments carried out with short focal distance intracavity applicators. This particular apparatus is so designed as to permit direct exposure of the intracavity tumor. The success of the use of the roentgen rays in the superficial variety of carcinoma prompted the direct intra-cavity employment of roentgen rays by one of us (L. H.) as early as 1932.[3] In spite of the crude form of tube, applicator and apparatus of that time, requiring long exposure for each treatment, results pointed definitely to the fact that, with improvement of apparatus and improvement of technic, great benefits would accrue.

This has been realized in part with a new shock-proof, water-cooled, short-focus tube, which utilizes a very low voltage (50 kilovolts), low amperage (4 milliamperes) and a 3 to 5 cm. focal distance. Daily exposure of the tumor to a 500-roentgen dose for from twenty to forty consecutive days has a tremendous local reaction, which destroys the tumor cells without causing too much disturbance of the tumor bed, an advantage which is of inestimable value during the process of healing. About 68 per cent of the daily dose is absorbed in the first centimeter of tumor tissue.

The procedure takes but a short time. It is easy for the patient and it is economical, as many patients can be treated daily. The extraction of otherwise good teeth is occasionally necessary to make room for insertion of the roentgen-ray-tube applicator.

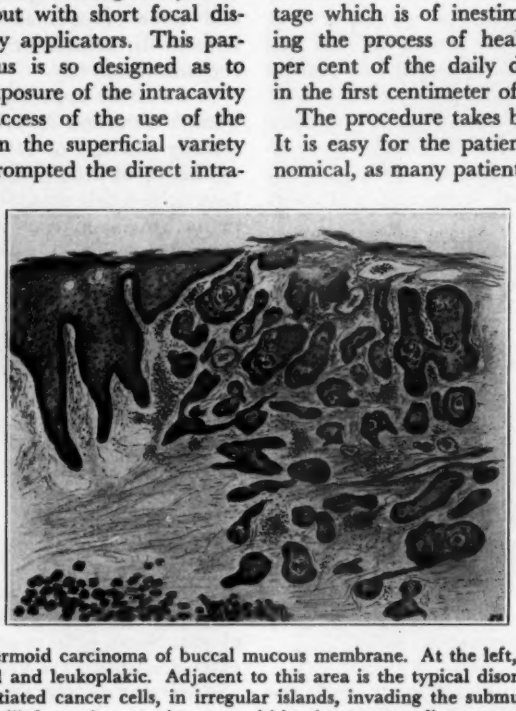

Fig. 19.—Epidermoid carcinoma of buccal mucous membrane. At the left, the mucous membrane is thickened and leukoplakic. Adjacent to this area is the typical disorderly arrangement of poorly differentiated cancer cells, in irregular islands, invading the submucous layer. Many examples of "pearl" formation can be seen within the tumor cell groups. A patchy inflammatory reaction is evident around and within the growth.

As stated above, it is our custom to irradiate an intra-oral carcinomatous area daily with 500 r. for twenty consecutive days, a total of 10,000 r. directly to the tumor. This amount of radiation usually suffices to destroy the neoplastic lesion. If not, further irradiation is car-

ried on, with the realization that a more extensive roentgen-ray burn will follow such massive treatment. Six or seven days after institution of the above-outlined treatment, the irradiated area will show a marked inflammatory reaction. Superficial necrosis will ensue at about the twelfth or fourteenth day, manifesting itself by the formation of a yellow enamel-like pyogenic membrane on a sharply defined area of inflammation, delineating the area irradiated. Accentuation of the above-described reaction will ensue during the remainder of the daily treatment and for about ten days after its completion, causing pain and burning, and an analgesic may be necessary. We have found codeine phosphate one-half grain with acetyl salicylic acid 7½ grains a good combination.

Four or five weeks after irradiation, the inflammatory reaction subsides completely and a healthy pink scar replaces the neoplastic lesion if the treatment is successful. Manifestations of roentgen-ray burns follow in from eighteen to thirty-six months and will appear with telangiectasia and atrophy.

When metastatic lymph nodes are exposable, they are treated with the same contact short-focus tube, the technic being as follows: Under local anesthesia, the skin, the subcutaneous tissue and, if necessary, the overlying muscle tissue are removed with a circular cut and the affected lymph node is exposed. This is treated daily with a 500 r. dose for a period of forty days to a total of 20,000 r. Between treatments, the lymph node is covered with sterile petrolatum gauze. Our results with this exposed method of treatment are becoming increasingly more satisfactory as we become more adept in its application.

If the lymph nodes are not exposable, we treat them with daily doses of heavily filtered irradiation according to the method of Coutard.

9. All of these procedures tend to exhaust the patient. It is necessary, therefore, to conserve the physical strength with an effective tonic and with support of the hematopoietic system, which will suffer greatly from the roentgen-ray irradiation. One needs to check these effects with frequent examinations of the blood picture for proper orientation. Vitamin B_1 up to 10,000 units a day, molasses, liver, the latter in the form of injections if necessary, a great deal of rest—all contribute to this supportive treatment during this very critical period. Narcosis and sedation both find places of application.

10. Arteriosclerosis, syphilis and secondary anemia are the most frequent concurrent conditions. A goodly portion of those suffering from carcinoma of the tongue are found to be syphilitic. It is almost universally held that these patients who have syphilis must not be treated with arsenic because it may act as an epidermal stimulant. The so-called mixed treatment will be the least harmful. We give these patients 5 grains of potassium iodide and one-sixteenth grain of mercury bichloride three times a day, unless it upsets the digestion or otherwise disturbs them.

We never discharge as cured a patient who has had intra-oral carcinoma because we believe that no criteria exist for determination of a cure. All the operative causes in carcinogenesis not being known, it is quite possible that new occurrences may develop even in the absence of recurrences. It is important to have the patient return for observation every three months if for no other reason than to inquire whether he has returned to his habitual use of tobacco or hot and irritating foods. It is important at each of these examinations to examine carefully the regional lymph node-bearing areas, in addition to general examination of the patient.

We believe that, with the institution of the above-outlined treatment, good results can be obtained in a fair number of instances. We are not quoting

figures because we believe that a statistical study is of questionable value. The quality and character of intra-oral carcinoma varies greatly with variable conditions, of which the age of the patient, the type of the tumor, the inherited quality of the tumor bed, the recognizable presence of local irritants and the trend and extent of the tumor development itself form but a few considerations. With so many variable factors, the form of treatment being the only uniform tangent, comparisons become difficult, and the conclusions drawn may be very fallacious. Thus, for the present, we are satisfied with the conclusion that, until further discoveries are made which will actually point in the direction of causation, and which are totally lacking today, regardless of volumes of literature to the contrary, the above-described method of treatment offers one of the best means of combating this very disquieting disease known as intra-oral carcinoma.

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ROENTGENOGRAPHIC AND MICROSCOPIC EVIDENCE AND THE PULPLESS TOOTH

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As the disposition to be made of the pulpless tooth is still a problem, it seems wise to consider the fact that all rarefied areas as viewed on the basis of roentgenographic evidence are not necessarily infected. Root-canal therapy often makes possible a healing and repair process which results in saving of the tooth and the elimination of the apparent infection.

Kronfeld[1] (Fig. 1) has shown a tooth which, according to the roentgenographic evidence, had a poor root-canal filling. Around the apex, a sharply outlined region of bone destruction, which was radiolucent, was noted. Into this radiolucent, or rarefied, area, there was projected the apex of the root.

In general, such a tooth would be condemned by dentists and physicians alike because the rarefied area would be considered infected. (Fig. 5.) Rather than evidence of improper treatment, it would be considered as indicative of an unavoidable failure as regards root-canal therapy.

This is unfortunate, for the reason that, when the case is studied on the basis of microscopic evidence, it immediately becomes clear that the space

From the Oral Pathology Department, Northwestern University Dental School.

around the apex is occupied by granulation tissue which is continuous with and attached to the surface of the tooth. Rather extensive resorptive and repair processes involving the dentin, cementum and adjoining bone are operative. In the presence of an active infectious process, this type of repair could not occur. Immediately over the apical foramen may be noted a few inflammatory exudate cells. The removal of the old root-canal filling and the proper treatment and refilling of the root-canal in such a case would have allowed for the kind of repair process exhibited in Figure 2, A, B and C.

Figure 2 illustrates a case similar to that represented in Figure 1. In this case Figure 2, A, a lower central incisor that contained a dead pulp, showed roentgenographically a large radiolucent area in the apical region. The dentist had been advised against treating and filling the root-canal as the patient was at that time undergoing treatment for stomach ulcers. The patient insisted, however, and, as a result, a simple mechanical broaching of the canal was carried out. When clean and dry, at a subsequent sitting, the canal was filled. (Fig. 2, B.) Figure 2, C shows the result twenty years later. The bone has

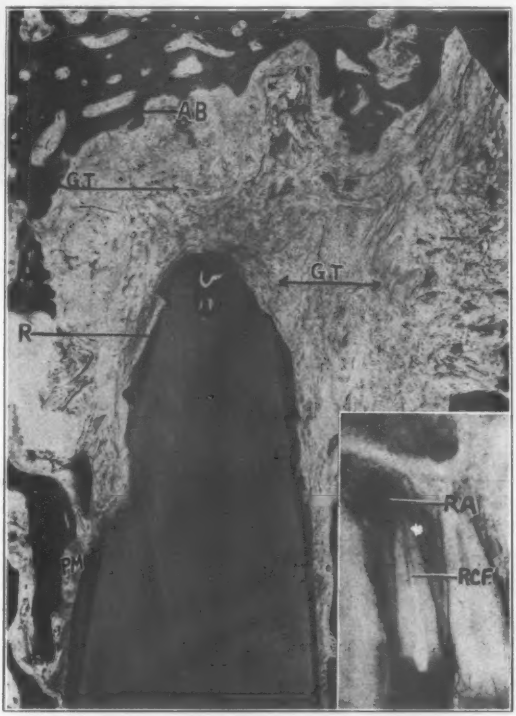
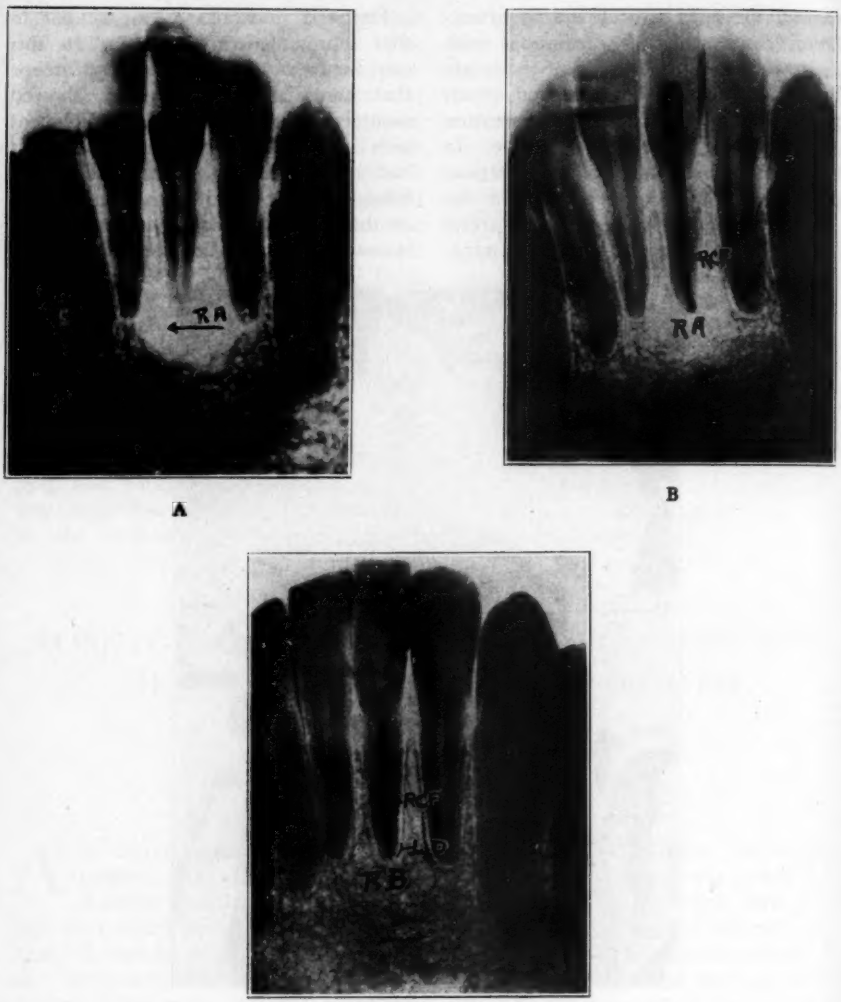


Fig. 1.—Solid granuloma; mesiodistal section through root end of upper lateral incisor with decomposed pulp and imperfect root canal filling. The roentgenogram taken before decalcification is inserted in the lower right corner. Ra, rarefied area. RCF, root canal filling. AB, alveolar bone. GT, granulation tissue occupying space between alveolar bone and root. R, resorption of root surface. PM, normal periodontal membrane. (Courtesy of Rudolf Kronfeld and Lea & Febiger.)



A B C

Fig. 2.—A, root apex projected into rarefied area. RA, rarefied area. B, completed root canal filling, RCF, with rarefied area, RA, still obvious. C, regeneration of bone, RB, and restoration of lamina dura, LD, which is just as normal as that of adjoining teeth, twenty years later, RCF.

regenerated. The peridental membrane line around the apex is apparently as nearly normal as that exhibited by the adjoining vital teeth.

Obviously, this is not a case of liquefaction necrosis (pus formation) as noted in Figure 5, with subsequent rebuilding, repair and reattachment. A much better analysis is predicated on evidence presented in Figure 1. Here, as no actual detachment has occurred, repair, or the replacement of soft connective tissue by

hard, namely, bone, requires only removal of the irritating elements contained in the root-canal.

All kinds of variations of the above-described condition exist. Many would allow for the same type of satisfactory healing as above described whether the teeth were single or multirooted. (Fig. 3.) In general, the same conditions shown in Figure 1 exist here except that the region immediately around the apex shows an increase in the amount of round-cell infiltration, as a reaction to material contained in the root-canal. Proper treatment here would undoubtedly result in healing. However, epithelial proliferations may also be attached to and continuous with the root apex. A case of Gottlieb's (Fig. 4) described by Kronfeld illustrates this effectively.

It is obvious then that neither the attached soft connective tissue (Fig. 1), nor the epithelium (Fig. 4), is revealed roentgenographically. They appear only as radiolucent areas. The general assumption is that all rarefied areas around root apices are hopelessly infected and therefore require the removal of the tooth. Figure 5 represents quite clearly the situation that is generally assumed

Fig. 3.—Mesiodistal section through apex of upper first bicuspid with granuloma. The roentgenogram of the specimen, inserted in the upper left corner, shows large areas of bone destruction around the root ends of both upper bicuspids, RA. AF, apical foramen. P, necrosis of tissue and formation of pus at foramen. I, dense cellular infiltration next to foramen. GT, granulation tissue. AB, alveolar bone. (Courtesy of Rudolf Kronfeld and Lea & Febiger.)

to exist when a radiolucent area is revealed on the basis of roentgenographic evidence.

In this case (Fig. 5), we also note a definite region of bone resorption, with its soft connective tissue replacement as residue, and which again is continuous with and attached to the surface of the root around the apical region. The root-canal contains necrotic pulp remnants. Just below the apical foramen is an abscess cavity containing an exudate in contact with the cementum of the root finally becomes infected. Obviously, then, the cases represented in Figures 4 and 5 would require either a root-end resection or extraction of the root to eliminate successfully such a rarefied area; whereas, cases represented in Figures 1, 2 and 3 would yield to root-canal therapy.

The elimination of a rarefied area as represented in Figure 2 is not so much a case of reattachment and rebuilding as of eliminating irritating elements from the root-canal so that the apical

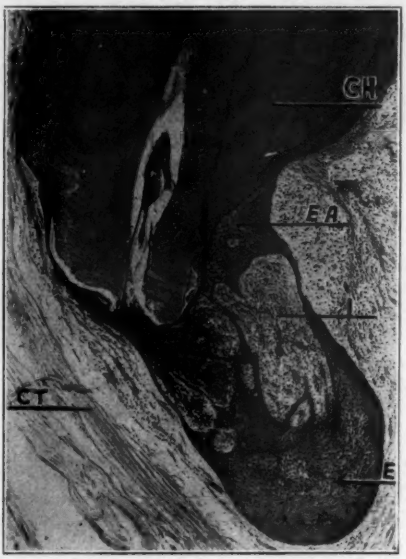


Fig. 4.—Root end of upper bicuspid with decomposed pulp; solid mass of epithelium present in apical granuloma. E, epithelial proliferation at and near root end. Ea, apparent epithelial attachment to root surface. CH, cementum hyperplasia above apparent epithelial attachment. I, round-cell infiltration in connective tissue between epithelial strands. CT, connective tissue capsule. (Courtesy of Rudolf Kronfeld and Lea & Febiger.)

apex. It should be noted that apparently the first change which occurs in the apical region is an inflammatory process resulting in resorption of bone and replacement of it by proliferating soft connective tissue or epithelium. Later, if the tooth root-canal is left untreated, the soft tissue contents liquefy; necrosis occurs or pus forms, and the root apex tissues already attached but not roentgenographically discernible will, when rid of such factors, again rebuild the bone around the root apex. (Fig. 2, A, B and C.) Therefore, rarefied areas, as long as they exist, should be considered as pathologic defects and on this account should be eradicated. It follows logically that if such cases yield to the above-sug-

gested treatments, the 100 per cent removal of all pulpless teeth would disregard the foregoing facts. It becomes increasingly clear that the roentgenogram does not accurately define what the radiolucent zone consists of; and because it merely reveals defects of contour of hard substances, namely tooth and bone, and not of the soft connective tissues or epithelium, no absolute diagnosis should be based on it.

Again, it follows that if considerable numbers of teeth containing degenerating or dead pulps or otherwise infected root-canals can be reclaimed by proper root-canal therapy, we should be able to treat successfully teeth not so definitely infected. Hence, we should, if our problem were properly evaluated, be able to manage successfully nearly all cases in which the pulp has been exposed by caries, but is still vital at the time treatment is instituted, and thus prevent the development of the above-considered rarefied areas.

Fig. 5.—Hyperplasia of cementum in proximity to chronic periapical inflammation; upper bicuspid. CH, cementum hyperplasia. RC, root canal containing necrotic pulp remnants. G, granuloma. A, abscess cavity containing purulent exudate. AB, alveolar bone. (Courtesy of William G. Skillen.)

We shall not at this time discuss the difficulties encountered because of calcification in the pulp chambers and canals of teeth nor complications associated with multiple foramina.

Moving in this general direction, the Oral Pathology Department, Northwest-

ern University Dental School, has realized that at this time there does not exist a suitable yardstick to measure and govern even a surgical or purely mechanical approach to the problem of root-canal therapy.

Therefore, it has been thought advisable to develop and study records of cases treated in our root-canal department by one method of treatment only, until sufficient statistical data have been accumulated to show how good or how bad it is before discarding it for other methods. Accordingly, the simple procedures in use in 1931, which consisted of a strictly mechanical or surgical approach to the problem, were continued. Unless infiltrative or conduction anesthesia preceded its application, the rubber dam was placed before the field of operation was sterilized with 70 per cent alcohol. All carious material was removed, as well as overhanging enamel walls. The pulp was exposed, usually by a large spoon excavator. If it was vital and had not been previously anesthetized as stated above, pressure anesthesia was used. The pulp was removed with fine and progressively larger barbed broaches. When all pulp remnants had been removed, suitable dressings were placed and, at a subsequent sitting, the root-canals were filled with gutta-percha. If the pulp was degenerating or dead, of course no anesthesia was used. This also was the case when retreatment of a tooth showing poor or incomplete root-canal filling seemed to be indicated, even though these fillings had been in place for some time.

It is recognized that more complicated methods of meeting the root-canal problem were available. They were avoided largely for the reason that no considerable body of statistics dealing with long periods of time is available to measure the success or failure of any method of root-canal therapy being used today.

Our purpose is to report findings only after a study has been made over a period of five years, dealing with case histories in which roentgenograms were made before treatment, on completion of the root-canal filling, six months later and at one, two, three, four and five year intervals. This, we felt, would avoid many of the misinterpretations which might be made of records over periods of time of less than five years.

The first group of this five year period present the following interesting facts:

1. Twelve cases had some bone involvement when root-canal therapy was instituted. They all had pulps that were described as being vital clinically. Of these, ten showed no change after treatment regardless of the fact that but three had properly condensed root-canal fillings. It is interesting to note, however, that, at the end of the second year, three cases seemed to regress; and at the end of the fifth year, one more had done so. More interesting, however, is the fact that also at the end of the second year eight of the twelve cases showed improvement; that is, reduction of the rarefied zone. This improvement was continued only in two cases when the five year period was reached. Hence, of these twelve cases, ten remained stationary and two improved by the end of the five year period. None regressed.

Eight cases of dead pulps in teeth with rarefied areas were treated. Of these, three remained stationary at the end of five years, while five showed improvement. The highest total of improvement occurred at the end of five years in these cases.

Of six cases of retreatment of teeth with old root-canal fillings and apical rarefaction at the time treatment was instituted, two remained stationary at the end of five years, while four showed improvement.

There were 126 cases treated that presented no bone involvement at the apex when treatment was instituted. Of these, ninety-nine showed no bone change at

the end of a five-year period. Of these, forty-five had properly condensed root-canal fillings and fifty-four did not. Twenty-seven cases showed retrogression, twenty-two of which had root-canal fillings that were short of the apex and were poorly condensed. Proper condensation then apparently has some bearing on success or failure.

Nine cases had dead pulps and showed no pathologic bone involvement when treatment was instituted. Eight continued stationary at the end of five years. One, which showed retrogression, had a root-canal filling that was properly condensed, but short of the apex.

There were five cases which showed no apical bone involvement, but which, because of old poor root-canal fillings and because they were to be used as abutment teeth for bridges, were re-treated. Of these, two had been properly condensed and reached to the apex. Three were poorly condensed and were short of the apex. All five continued normal for the five year period.

CONCLUSION

1. The roentgenogram accurately delineates the amount of bone involvement at the apex of the tooth, but does not make clear of what the radiolucent zone consists. It does not reveal the presence or absence of soft connective tissue or epithelium or liquefaction necrosis (pus formation). Therefore, no absolute diagnosis should be made from it.

2. Root-canal therapy offers definite possibilities for eradicating many radiolucent zones.

3. When a yardstick has been developed for a particular method of root-canal therapy, a starting point will be furnished for comparison with various other methods.

4. Statistics based on cases treated and studied in the Oral Pathology Department of Northwestern University Dental School present several interesting facts:

(a) We have not, with the method used, been 100 per cent successful.

(b) We have demonstrated that improvements do occur even when teeth showing apical rarefaction are treated.

(c) We have demonstrated that in quiescent cases, with old root-canal fillings that are short of the apex, when the filling has been improved, in many cases improvement in the periapical bone condition has also resulted.

(d) Too large a percentage of vital pulp cases showing no apical involvement at the time treatment was instituted failed; namely, twenty-seven of 126 cases. This may be due to technical faults in student management of cases.

5. We propose to continue these studies, and after several thousand are available, we shall again report our findings, after which we propose, together with others, to try every method possible to improve the management of the root-canal problem.

6. We must conclude that, on the basis of evidence presented, root-canal therapy has definite possibilities and is not so hopeless as it is generally considered to be.

7. Many teeth have undoubtedly been extracted because the roentgenogram is supposed to afford absolute evidence. On the contrary, such teeth are probably extracted because the roentgenographic evidence is so inadequate that it does not differentiate between attachments, epithelial and soft connective tissue; detachment and liquefaction, necrosis and pus.

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LUDWIG'S ANGINA: REPORT OF TWO CASES

By Joseph A. Doherty, D.M.D., B.S., M.S., Boston, Mass.

THE clinical entity characterized by a diffuse phlegmonous inflammation of the submaxillary region and the floor of the mouth has long been the subject of study from anatomic, pathologic and surgical viewpoints. As a consequence, it is now recognized to be a separate disease, as distinct in its symptomatology as is appendicitis. The location, predisposing to complications, and the high rate of mortality have given to it an importance in keeping with its gravity. The opinions herein expressed are based upon clinical observations, supplemented by a review of the literature. The dominant rôle of oral infection as an etiologic factor, as emphasized by most clinicians, imposes upon the members of the dental profession a serious responsibility as guardians of the oral health of the community.

HISTORICAL

In 1836, Friedrich von Ludwig,[1] of Württemberg, Germany, gave a classical description of the disease that now bears his name. Subsequent writers have elaborated upon this original monograph, but have in nowise altered the basic prerequisites which he recorded so clearly and comprehensively. The article was given editorial comment in the *Gazette médicale de Paris* and in Schmidt's *Jahrbücher,* from which gradually emanated information pertaining to this newly recognized malady. Ludwig discerned the following salient features: (1) an inflammation of the cellular tissues; (2) origination about the submaxillary salivary gland; (3) subsequent invasion of the neck and floor of the mouth, and (4) a course that grew progressively worse, death following in ten or twelve days, or gradual recovery.

Ludwig further noted that the edema was not the customary type, but of a woodlike hardness; that there was present a hard swelling under the tongue, and that there was an absence of infection of the glands although the surrounding cellular tissue was involved. He believed that the disease which he described might appropriately be called an inflammatory hardening of the cellular tissue of the neck. The inflamed condition of the throat led him to designate the condition "an angina," from the Latin *angere,* meaning to strangle or suffocate. At necropsy, there was revealed a phlegmonous condition of the submaxillary and sublingual regions. Evidence existed of extension into the mediastinum.

For a long time, the idea that Ludwig's angina was a specific disease was disavowed. Some contended that it was the ordinary type of cellulitis commonly found in other parts of the body. Konig[2] believed it to be a submaxillary abscess, admittedly extremely dangerous, but not to be considered a separate disease. Semon[3] and Boehler,[4] the latter's thesis being frequently quoted, reasoned that because it was always secondary to a focus in the mouth, it was not a definite disease. It was not until the early

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part of the twentieth century, through discourses by Davis,[5] Thomas[6] and Price,[7] preceded by important discussions by French surgeons, that the disease received general recognition. That today many neck infections characterized by a sublingual phlegmon are erroneously classed as Ludwig's angina can be attributed to a lack of acquaintance with the classical symptoms enunciated by the Stuttgart physician.

ANATOMY

A knowledge of the surgical anatomy of the field concerned is essential to accurate diagnosis and proper treatment. The regions of importance are the submaxillary and submental spaces; the structures, the mylohyoid muscle and the deep cervical fascia. The submaxillary triangle or space corresponds to the region of the neck immediately below and inside the body of the mandible. Its floor is formed principally by the mylohyoid and hyoglossus muscles. Within this area lies the submaxillary gland. The submental space (suprahyoid triangle), located beneath the tongue, is limited behind by the anterior belly of the digastric, in front by the midline of the neck and below by the hyoid bone and mylohyoid muscle. Above, it is covered by the mucous membrane of the mouth. Thomas pointed out the continuity of the cellular tissue in the submaxillary and submental areas. Thus is explained the anatomic basis for the rapid extension of a submaxillary cellulitis to the floor of the mouth.

The mylohyoid muscle, flat and triangular, is situated immediately above the anterior belly of the digastric, forming with its fellow of the opposite side a muscular floor for the cavity of the mouth. It arises from the whole length of the mylohyoid line of the mandible, extending from the symphysis is front to the last molar tooth behind. The posterior fibers pass medially and slightly downward to be inserted in the body of the hyoid bone; the middle and anterior fibers, into a median fibrous raphe.[8] This muscular diaphragm acts as a definite barrier to the anterior or external spread of infection in the floor of the mouth. The deep cervical fascia lies beneath the platysma and invests the neck. It arises from the whole length of the inferior body of the mandible including the symphysis menti. It passes downward to attach itself to the body of the hyoid bone.

GENERAL CONSIDERATIONS

Many investigations have been carried on to determine the manner in which the infection spreads. Some have contended that it was not a cellulitis, but an inflammatory involvement of the lymphatic system. This view was expressed by Tillaux[9] and by Poulsen.[10] Hamann[11] entertained the belief, long since abandoned, that Ludwig's angina was due to inflammation spreading along the ducts of the submaxillary and sublingual salivary glands. The general concept today is that the inflammatory process is confined principally to the cellular tissue. The submaxillary and sublingual salivary glands and lymph nodes may become secondarily infected, but are never diseased primarily. It should be carefully noted that only when the submaxillary and submental areas are simultaneously involved in a confluent septic cellulitis does the condition warrant being classified as a Ludwig's angina. If confined only to the submaxillary fossa, it is a submaxillary cellulitis. If isolated in only the sublingual region, it is a sublingual cellulitis. That it is immaterial which region is first invaded is in conformity with the observations of Ludwig. The majority of studies reveal the submaxillary space as the initially involved area. In the cases here reported, the cellulitis was likewise primary in the submaxillary region.

The focus of infection has been vari-

ously attributed to the tongue, tonsils, salivary gland ducts and impacted necrotic teeth. Dental infection has been the most common etiologic factor, in one series of cases aggregating 61 per cent.[13] Ludwig's angina has followed the removal of the lower molars. In one case reported, the infection started in an upper tooth, invading the tissues of the side of the face before reaching the submaxillary region.[18] Nowhere in the mouth should a conservative approach and an adherence to surgical principles be more rigidly maintained than in operating in the posterior part of the mandible. As emphasized in a recent paper,[14] the lancing of the acutely inflamed operculum overlying the third molar is to be wholeheartedly discouraged. The causative organism in the majority of cases is *Streptococcus hemolyticus.* Cultures often show in addition the staphylococcus and various anaerobic organisms. In one series of cases, the constancy and predominance of Vincent's organism led to the routine use of neo-arsphenamine intravenously, with most gratifying results.[15] In view of the presence of *Streptococcus hemolyticus,* it is but natural to expect that sulfanilamide would be utilized as a therapeutic agent. The use of this drug appears to have a localizing influence upon the infection.[16] The prognosis is grave. The mortality rate has undergone slight variation, still hovering around the 50 per cent mark. The disease occurs most frequently in males between 20 and 30 years of age, although one case reported was that of a 5-year-old child.

DIAGNOSIS AND TREATMENT

The disease in its early stages starts as a painful indurated swelling in the submaxillary or submental region. Associated symptoms are malaise, difficulty in swallowing, trismus and increased salivation. Very shortly, the inflammatory process spreads throughout the cellular tissue. The swelling becomes hard and boardlike and the mucous membrane of the floor of the mouth is elevated to the level of the incisal edges of the lower teeth, the tongue tending to fill the whole mouth. As a rule, there is concomitant embarrassment of the respiration. The skin presents a brawny rather than edematous appearance. The temperature is elevated, though not necessarily high, and a moderate leukocytosis may be present. When the phlegmonous process of Ludwig's angina is well advanced, the picture is so striking that it is neither difficult to recognize nor easy to forget.

Once the diagnosis is made, immediate incision and drainage are indicated. It is immaterial whether pus is present. Surgical interference is not instituted to drain a suppurative area as in the case of an ordinary cellulitis of the submaxillary region or of some other part of the body. In such cases, surgical measures may be deferred, often with advantage, until localization of the infection has occurred. Not so, however, in Ludwig's angina. A patient so affected is gradually being strangled, the air passages undergoing closure from the tension of the edematous tissues. Every effort is being made to obtain air as the swollen tongue is increasingly exerting pressure against the posterior wall of the pharynx. Respiration is becoming faster and shallower. Oxygenation of the body tissues is reaching the vanishing point. Solely by surgical interference can the desired relief be obtained.

The type and location of the incision are very important. Only when it is made with a knowledge of the anatomic field and based on a definite procedure can the dyspnea be alleviated. The incision should run just below the border of the mandible, extending from the angle to the symphysis. Not only are the skin and platysma to be penetrated, but the mylohyoid muscle and cervical fascia should also be severed. In addition, the anterior belly of the digastric muscle must

be cut. Thus, the submaxillary and submental regions are exposed. Search for pus should always be made. The only structures of importance in this region are the facial artery and vein which ascend the mandible anteriorly to the attachment of the masseter muscle. The floor of the mouth, when freed of tension, tends to descend along with the tongue, with resultant disappearance of the impediment to respiration. The wound is packed with gauze and left open. The sudden possibility of a need for tracheotomy requires that the proper instruments be available at all times. In one series of cases, tracheotomy was found to be necessary in three instances.

Because of partial occlusion of the respiratory passages, the choice of anesthetic has been given serious consideration by many surgeons. In general, inhalation anesthesia is contraindicated. Inability to maintain an open airway is the greatest disadvantage to its use. Intravenous agents have been found quite satisfactory in some hands.[17] However, the anesthetic of choice is procaine. It does not meet all requirements, since anesthesia of the deep tissues is not always complete. It does, however, offer the greatest margin of safety to the patient.

REPORT OF CASES

CASE 1.—A man, aged 30, a strong muscular type, admitted to hospital February 16, 1937, presented the typical signs and symptoms of Ludwig's angina. There was a history of sore throat eight days previous to admission. For the past five days, he had swallowed only with difficulty. The left molar teeth had been painful for several weeks, one having been recently removed.

Examination revealed a marked cellulitis of the left submaxillary region extending to and across the median line. The tongue was swollen to almost three times normal size. Respiration was short and labored. The breath was foul, the sputum dark. The patient was greatly dehydrated. Prontosil was administered by mouth. A clysis of 1,000 cc. of saline solution with 5 per cent glucose was given. The prontosil was continued the following days, being administered both orally and intravenously. The temperature rose to 104. The patient made an uneventful recovery. He was discharged February 24. Surgical intervention was never necessary.

CASE 2.—A man, aged 26, a college student, well nourished and well developed, was admitted to hospital April 14, 1938, the chief complaint being pain at the angle of the mandible accompanied by difficulty in swallowing. Four days before admission, tenderness developed in the left molar area, becoming progressively worse. Examination revealed a submaxillary cellulitis. Because of trismus, the opening of the mouth was greatly restricted. The cellulitis spread anteriorly, involving the submental region, which became hard and elevated. The temperature was 102.4.

At operation, a horizontal incision was made just below the lower border of the mandible. The submaxillary and sublingual regions were exposed, a thick foul-smelling pus being obtained. The wound was packed with plain tape. Rapid improvement followed. Eight days later, the patient was discharged.

SUMMARY

1. Ludwig's angina is a clinical entity characterized by an acute diffuse cellulitis of the submaxillary region and the floor of the mouth.

2. The high mortality emphasizes the seriousness of the disease, which tends to spread rapidly, with potential occlusion of the respiratory passages and invasion of the mediastinum.

3. The predominating focus is dental infection. The causative organisms most often are the streptococcus and *Borrelia vincenti.*

4. Treatment is principally surgical, incision and drainage being instituted as early as possible. As a therapeutic agent, sulfanilamide is to be recommended.

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The Warren Chambers.

CONGENITAL ABSENCE OF TEETH

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INTRODUCTION

NUMERICAL aberrations in the human dentition result from the presence of supernumerary teeth or the absence of teeth. The latter condition is designated as "anodontia" if there is a total absence of teeth, and as "oligodontia" if several teeth are missing. The maxillary second incisor, the mandibular first incisor, the maxillary and mandibular second premolars and the maxillary third molar are missing more frequently than other teeth, although any tooth or any combination of teeth can be involved. Occasionally, there is a tendency to symmetrical variation, with the same tooth missing on each side of the arch, the same tooth missing on one side of the arch and in each jaw or the same tooth missing on each side of the arch and in each jaw.

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Read at the Eighteenth Annual Meeting of the International Association for Dental Research, Philadelphia, Pa., March 13, 1940.

Various theories have been offered as to the cause of this phenomenon of missing teeth. Syphilis, endocrine gland disturbance, rickets, tuberculosis and heredity are listed as etiologic factors, with a possibility that each may be responsible, in certain instances, for suppression of the dentition. Heredity seems to have the strongest case of all, but, in general, the etiology of dental dystrophy is obscure and can be ascribed to some unknown condition resulting in partial or complete aplasia of the dental lamina.

LITERATURE

Fifty-seven years ago, Guilford[1] (1883) reported the case of a man, 48 years of age, who had been edentulous from birth. While it is true that the x-rays had not been discovered at that time, and therefore the possibility of unerupted teeth existed, it is nevertheless evident, from the clinical description and the illustrations, that it was a case of anodontia associated with ectodermal dysplasia of the anhidrotic type. Similar cases of com-

plete or partial absence of teeth associated with this affliction have been recorded by Roberts[2] (1929), Hill[3] (1933), Thoma[4] (1934), Thannhauser[5] (1936), Lord and Wolfe[6] (1938) and Cook[7] (1939). Gardner and Dillery[8] (1934) discuss the case of a boy, aged 15, with twenty-three permanent teeth missing. Keeler[9] (1935) lists the pedigrees of several families with missing teeth. Battersby[10] (1936) presented the case of a boy, aged 9, with complete absence of both dentitions. Steuer[11] (1936) described an 11-year-old girl with all the permanent teeth missing except the maxillary first incisors and the mandibular first molars. Dahlberg[12] (1937) reported a 12-year-old boy with the maxillary second incisors, the mandibular first and second incisors and the right mandibular second premolar missing. Miller[13] (1937) presented the case of a 13-year-old girl with nine permanent teeth missing. Sly[14] (1938) described a 12-year-old girl with the maxillary second incisors and the mandibular second premolars missing. Gray[15] (1938) published an account of a 9-year-old boy with six deciduous and thirty permanent teeth absent. Warr[16] (1938) recorded the case of a 12-year-old boy, with the deciduous maxillary second incisors and all permanent teeth missing. The child was otherwise normal, and no evidence of dental anomalies could be traced on either side of the family. Schultz[17] (1938) reported the case of a 3-year-old girl, normal except for complete absence of tooth development as shown by an x-ray examination. Werther and Rothenberg[18] (1939) described a 15-

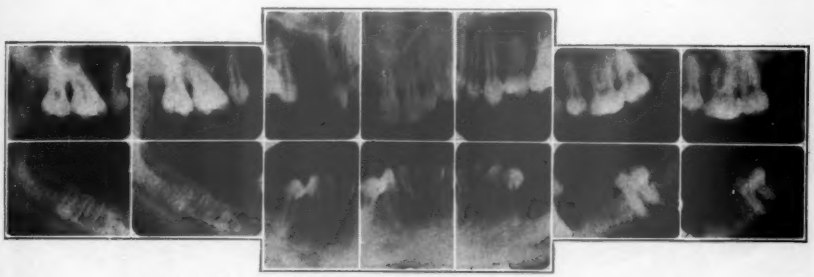

Fig. 1 (Child 1).—X-ray survey showing absence of eleven teeth.

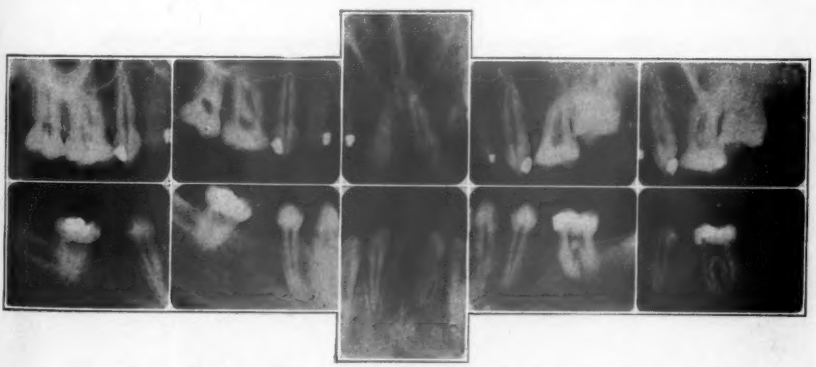

Fig. 2 (Child 3).—X-ray examination showing sixteen teeth missing.

year-old girl with all the teeth missing except the following: R $\frac{6\ c\ 1 \mid 1\ c}{c \mid c\ 4\ 6}$ L.*

In a previous communication,[19] oligodontia in two of a family of eight children was reported. Inadvertently, because of undue credence in parental information, the statement was made that numerical variation did not exist in the remaining six children. An opportunity for additional study of this family has revealed that five of the eight children have congenitally missing teeth.

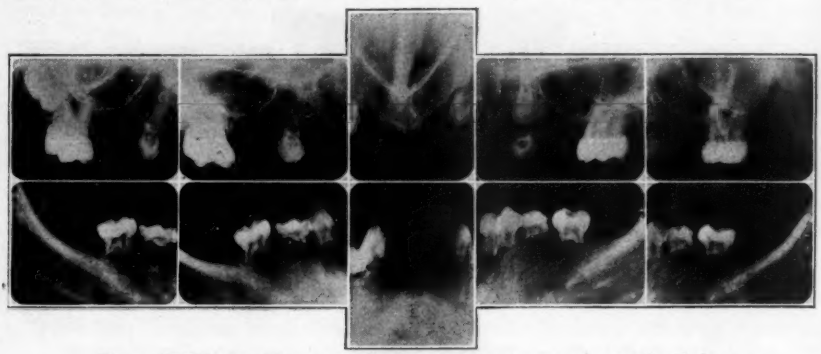

Fig. 3 (Child 4).—X-ray examination showing twenty-nine teeth missing.

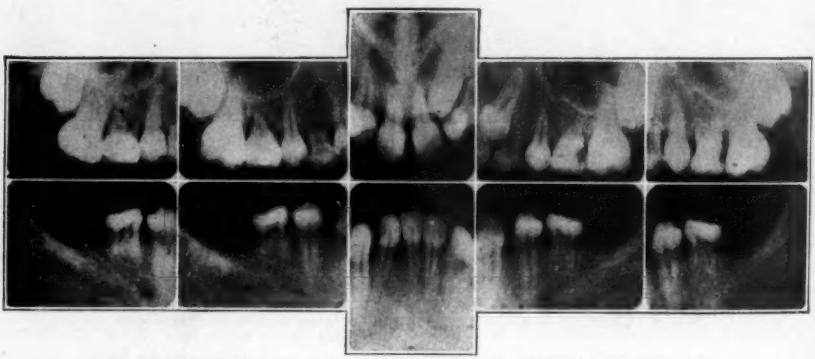

Fig. 4 (Child 5).—Fourteen teeth revealed as missing in x-ray survey.

HISTORY OF "C" FAMILY

The father, G.A.C., born in Greece, of Greek parents, in December 1888. His father was still living in Greece at the age of about 71. His mother died at the age of 55. An x-ray survey of his teeth was made January 11, 1938 and the dentition was found to be normal. The following teeth were missing, with evidence that they had been removed: $\frac{\mid 4\ 7}{8 \mid}$ were missing, with no recollection of tooth removal. $\frac{4\ 3 \mid 8}{}$ have since been removed.

The mother, L.M.C., was born in Arkansas of Irish-Dutch parentage, November 14, 1888. Her father died at the age of 76 and her mother at 73. Each parent had most of the natural teeth remaining at death, but a possibility of tooth deficiency existed.

An x-ray survey of the edentulous jaws of L.M.C. was made January 5, 1939. No unerupted teeth were present. The patient had lost the remainder of her natural teeth at 32. There was a recollection of tooth deficiency, but nothing definite could be determined. According to her description, she was "snaggle-toothed," and had several teeth

*In this system of notation of the teeth, figures in arabic numerals signify the permanent teeth, and small letters represent the deciduous teeth.

missing. Data beyond the parents are not available.

To this couple, eight children were born, all of whom are living. All of these children are of normal intelligence, but small of stature. All are devoid of polydactylism, oligodactylism or ectodermal anomalies. Physical and serologic examinations were negative. No information was available as to tooth anomalies or numerical deficiency in the deciduous dentition of any of these children.

Child 1, E.C.G., a girl, born December 15, 1917, and married, had a daughter born March 20, 1936 and a son born January 2, 1938. An x-ray survey of the teeth of E.C.G. was made February 9, 1939. (Fig. 1.) The following teeth were present, according to the formula: R $\frac{7\,6\,4\,3\,2\,1\,|\,1\,3\,6\,7}{7\,4\,3\,2\,1\,|\,1\,2\,3\,4}$ L $\frac{}{6\,|\,6}$ had been recently removed.

Missing teeth were: $\frac{8\,5\,|\,2\,4\,5\,8}{8\,5\,|\,5\,7\,8}$; a total of 11.

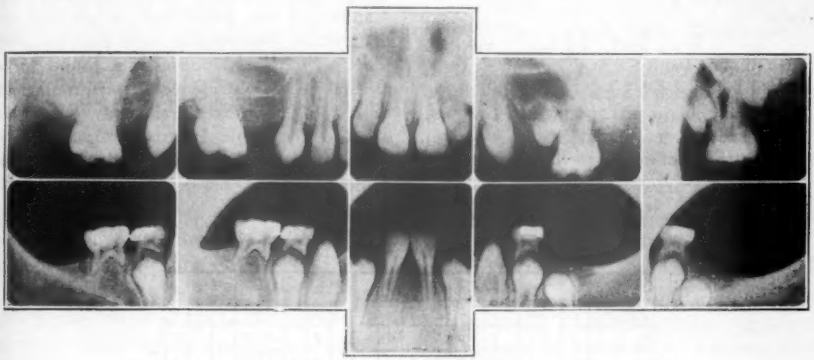

Fig. 5 (Child 7).—X-ray survey revealing fourteen teeth missing.

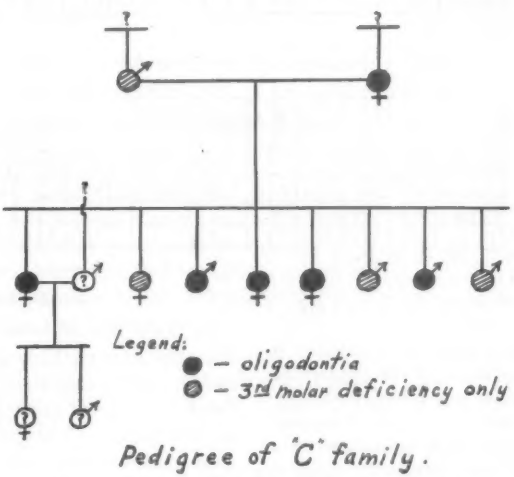

Fig. 6.—Study of tooth deficiency in "C" family.

Child 2, D.C., a girl, born January 19, 1919, had an x-ray survey made January 13, 1940. The dentition was found to be normal, except that $\underline{8}|$ was missing, with no recollection of having had the tooth removed.

Child 3, J.C., a boy, born February 2,

1922, had an x-ray examination made December 18, 1937. (Fig. 2.) The following teeth were present:

R $\frac{7\ 6\ 3\ c\ 1 \mid 1\ c\ 3\ 6\ 7}{6\ 4\ 3\ 2 \mid 2\ 3\ 4\ 6}$ L.

The missing teeth were: $\frac{8\ 5\ 4\ 3 \mid 2\ 4\ 5\ 8}{8\ 7\ 5\ 1 \mid 1\ 5\ 7\ 8}$ a total of 16.

Child 4, K.C., a girl, born October 15, 1923, had an x-ray survey made February 12, 1937. (Fig. 3.) The following teeth were present:

R $\frac{e\ c \mid c\ 6\ 7}{e\ d\ c\ b \mid c\ d\ e}$ L.

The missing teeth were:

$\frac{8\ 7\ 5\ 4\ 3\ 2\ 1 \mid 1\ 2\ 3\ 4\ 5\ 6\ 8}{8\ 7\ 6\ 5\ 4\ 3\ 2\ 1 \mid 1\ 2\ 3\ 4\ 5\ 6\ 7\ 8}$; a total of 29.

Child 5, G.C., a girl, born July 14, 1925, had an x-ray survey made January 28, 1939. (Fig. 4.) The following teeth were present:

R $\frac{7\ 6\ e\ 4\ c\ 3\ 2\ 1 \mid 1\ 3\ c\ 4\ e\ 6\ 7}{e\ 4\ 3\ 2\ 1 \mid 2\ 3\ 4\ e}$ L

Child 6, R.C., a boy, born January 9, 1927, had an x-ray survey made January 21, 1939. The dentition was found to be normal. The mandibular third molar buds were present; the maxillary third molar buds missing. An additional x-ray survey of $\frac{8 \mid 8}{8 \mid 8}$ was made February 10, 1940. The mandibular third molars were developing. No maxillary third molars were present.

Child 7, D.C., a boy, born August 21, 1929, had an x-ray survey made January 21, 1939. (Fig. 5.) The following teeth were present: R $\frac{7\ 6\ 5\ 3\ 2\ 1 \mid 1\ 2\ 3\ 6\ 7}{5\ d\ 3\ 2 \mid 2\ 3\ d\ e}$ L.

The missing teeth were: $\frac{8\ 4 \mid 4\ 5\ 8}{8\ 7\ 6\ 1 \mid 1\ 5\ 6\ 7\ 8}$ a total of 14.

Child 8, R.C., a boy, born June 5, 1931, had an x-ray survey made January 28, 1939. All maxillary deciduous teeth were present; all mandibular deciduous teeth were present except the incisors. Both maxillary and mandibular first permanent molars, and the mandibular first incisors were fully erupted. The permanent dentition was found to be normal, with no evidence of third molar calcification. An extra-oral x-ray survey of $\frac{8 \mid 8}{8 \mid 8}$ was made February 10, 1940. No maxillary or mandibular third molars were present.

TABLE 1.—MAXILLARY TEETH THAT ARE MISSING.

	Sex		8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Child 1	♀	R	0			0						0		0	0			0	L
Child 3	♂		0			0	0		0			0		0	0			0	
Child 4	♀		0	0		0	0	0	0	0	0	0	0	0	0			0	
Child 5	♀		0			0						0			0			0	
Child 7	♂		0				0							0	0			0	

0 – missing

TABLE 2.—MANDIBULAR TEETH THAT ARE MISSING.

	Sex		8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Child 1	♀	R	0			0									0		0	0	L
Child 3	♂		0	0		0				0	0				0		0	0	
Child 4	♀		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Child 5	♀		0	0	0	0					0				0	0	0	0	
Child 7	♂		0	0	0					0	0				0	0	0	0	

COMMENT

In these five afflicted children, a total of eighty-four teeth are missing. (Tables 1 and 2.) Both maxillary and mandibular third molars are missing in all children of this group. The left maxillary and mandibular second premolars and the left mandibular second molars are absent in all of the affected group. In children 1, 3, 4 and 5, the right maxillary and mandibular second premolars and the left maxillary second incisor are missing. In children 3, 4, 5 and 7, the right mandibular second molar and the left mandibular first incisor are missing. In

children 4, 5 and 7, all mandibular molars are absent. In child 4, all mandibular teeth are missing.

An interesting observation in child 3 is that the missing teeth are bilaterally identical in each jaw.

The pedigree of this family is represented in Figure 6. The children in F_2 are too young to be studied for tooth deficiency in the permanent dentition. January 17, 1940, these children were examined and found to be normal. The oral examination of G.G. (female) revealed a normal complement of deciduous teeth without anomalies. The oral examination of K.E.G. (male) revealed normal deciduous teeth, fully erupted, except $\frac{\cdot|\cdot}{\cdot|\cdot}$, but the age of the child could account for lack of eruption of these teeth.

Children 2, 6 and 8 (the unaffected group) all have some third molar deficiency. Child 2 has the right maxillary third molar missing; child 6 has both maxillary third molars missing, and child 8 has all third molars missing.

July 17, 1940, the mouth of K.E.G., the son of Child 1, was examined. All deciduous second molars were erupted.*

It will be observed in Figure 6 that this characteristic of tooth deficiency apparently follows a hereditary pattern that is not sex linked. Burks,[20] in reviewing the pedigree of this family, was of the opinion that the hereditary predisposition came from both mother and father, the one having a multiple tooth deficiency, the other a third molar deficiency.

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*Examination made subsequently to the presentation of the paper.

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UTILIZATION OF BIOLOGIC PRINCIPLES IN THE PRACTICE OF OPERATIVE DENTISTRY. I. DIAGNOSIS OF CARIOUS LESIONS

By S. S. Arnim, B.A., D.D.S., Ph.D., Richmond, Va.

LOYAL DAVIS,[1] in a discussion of the problem of teaching surgery, says:

A successful solution to the problem means that the teachers of the principles of surgery must constantly approach their subject from the standpoint of the basic sciences. The student must be taught day after day that the symptoms of appendicitis are due to certain pathological changes in that structure produced by infection, and that those changes alter the physiology of the intestinal tract; that the symptoms of peritonitis, the result of rupture of a gangrenous appendix, are accompanied by changes in the biochemical constitution of the body. This would seem to be simple and axiomatic, but, for some reason, the term "clinical teacher" or "clinical teaching" has seemed to imply a complete divorcement from a logical application of the facts learned in the first two or "pre-clinical" years, in the minds of the teacher and pupil alike.

The purpose of this paper is to show how the logical application of facts learned in the preclinical courses in dental schools proves useful in the practice of operative dentistry. The problem of mouth examination for carious lesions or "cavities" will be discussed in detail.

From the Department of Operative Dentistry, Medical College of Virginia, School of Dentistry.

Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 11, 1940.

Let us consider a hypothetical patient, a man 22 years of age. He enters the office and requests a thorough mouth examination. How can we apply preclinical learning to this situation? Will our "theoretical" knowledge be of real value during the solution of this "practical" problem?

As students, we were imbued with the idea that "theory" courses had little clinical application. Experience teaches some of us that this idea proves costly in dental practice. There is a fund of knowledge disseminated in the biologic sciences, dental anatomy, histology, bacteriology, biochemistry and pathology that is of inestimable value when it is logically applied to the problem of mouth examination.

As an example, let us consider those studies dealing with cavity incidence. We learn in dental pathology that almost all of the people in the United States have some carious lesions. Serious consideration of this fact should inspire a thorough and systematic search for signs of this disease. It should discourage the common practice of haphazard mouth mirror and explorer examination. The usual criterion for the presence of a carious lesion, namely a spot on the tooth surface where an explorer catches, is not wholly satisfactory to the scientific operator. He soon determines clinically that the use of this single sign during mouth examination yields figures on cavity incidence that are far below

the average reported in the literature.

The use of statistical studies of cavity incidence is extremely helpful to the dentist in his search for carious lesions. R. W. Leigh[2] examined 7,942 young men 17-24 years of age in an effort to determine which teeth and which tooth surfaces were the more likely to become affected by dental caries. An examination of the chart, prepared from a study of his data, reveals the following facts:

1. The occlusal surfaces of all first molars and lower second molars are affected by the carious process oftener than is any other tooth surface.

2. The occlusal surfaces of the upper second molars are next in order.

3. The occlusal surfaces of the upper bicuspids and lower second bicuspids and the mesial surfaces of the first molars form the next group.

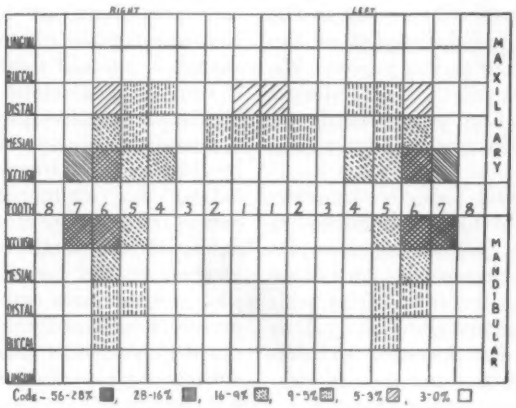
4. The distal surfaces of the upper bicuspids, the lower second bicuspids and the first molars; the mesial surfaces of the upper second bicuspids, central and lateral incisors, and the buccal surfaces of the lower first molars form the fourth group.

5. The distal surfaces of the upper first molars are the next in order.

6. Cavity incidence is remarkably bilateral.

The logical application of the foregoing facts tells us much about our patient before we actually begin our clinical examination. If he is an average young man, we may expect to find carious lesions or their consequences on the occlusal surfaces of the first molars and the lower second molars. Approximately one of every four occlusal surfaces of upper second molars are carious at this age. If, on examination, we find a cavity on the mesial surface of a lower first molar, we may expect to find evidence of carious lesions on all those surfaces that are equally liable to attack by the carious process. The probability that cavities will occur on corresponding sites on opposite sides of the arch is extremely high. Equally useful charts covering a wider age range may be prepared from data published by Hyatt[3] and by Cohen.[4]

Consideration of the facts outlined above stimulates us during our search for carious lesions. If the young man that we are examining does not fit into the average group, his becomes an un-



usually interesting case requiring an exceptionally thorough examination. Conscientious application of this knowledge in practice reveals that there are extremely few persons who have less than the average number of cavities. "Theory" applied to clinical practice serves as an effective guard against hasty, careless mouth examinations in this instance. Clinical experience proves that this fundamental knowledge is of practical value during mouth examination.

Now that we have discussed the average number and position of cavities, another problem confronts us. What changes associated with the carious process reveal the presence of cavities most definitely? How are we to differentiate these changes from those that accompany other diseases? The answer to this question lies in our knowledge of the pathogenesis of the carious process. We find ourselves relying on the preclinical sciences again. Can we define dental caries in a manner that has clinical significance?

Primarily, dental caries is characterized by a loss of tooth substance that may lead to a loss of function. Its presence can be detected by the following signs: 1. Cavitation associated with débris. 2. Loss of translucency. 3. Loss of hardness. 4. Discoloration. In addition, the patient may complain of pain associated with the carious process.

Our present concept of the pathogenesis of the disease may be summarized as follows: Bacteria and débris accumulate on tooth surfaces in protected areas. Left undisturbed, they become more or less firmly organized and attached to the tooth surface in a formation commonly called a plaque. Following the introduction of certain types of foodstuffs into the mouth, acid formation begins very quickly at the site of the plaque. It continues and is detectable for varying lengths of time. The acid acts on the inorganic elements of tooth structure, bringing about its gradual dissolution with the formation of a microscopic cavity. The common sites of occurrence of carious lesions are pits, fissures and contact areas. The lesion, as it progresses, follows the general direction of the enamel rods, spreads at the dentino-enamel junction and continues along the dentinal tubules. Recognition of this characteristic route of attack is of extreme value in differentiating carious lesions from marked enamel hypoplasia. A thorough knowledge of the common sites of occurrence and the pathogenesis of both types of lesions is necessary in order to differentiate them accurately.

As the dissolution of enamel takes place intermittently and comparatively slowly, the surface outline of the tooth is seldom destroyed in early lesions. Macroscopic cavitation occurs after the enamel is softened to the extent that it is completely dissolved by the acid or broken away during the stresses of mastication. The space formerly occupied by hard tooth structure serves as a lodging for additional bacteria and débris. Destruction of the organic elements of the tooth accompanies the progress of the carious lesion. If the patient experiences any pain during this process, it supposedly occurs at the time the dentino-enamel junction is first involved. Pain sometimes follows chemical, mechanical or thermal injury after the process has involved the dentin.

The macroscopic signs of an early carious lesion are: formation of the plaque, loss of translucency and softening of the enamel. As the lesion progresses, macroscopic cavitation of the tooth surface occurs. Discoloration of the affected tooth substance is brought about by the ingress of foreign matter. This sign is encountered most frequently in those lesions that progress slowly. Rapid dissolution of tooth substance results in the loss of tooth elements before they have had time to become markedly discolored.

So far, I have confined the discussion of the pathogenesis of the carious lesion to its theoretical aspects. How are we to apply this knowledge to the problem of examination of the young man in the chair? It is here that we reach the crucial point in our discussion. In order to profit from the logical application of scientific thought and method to the problem of mouth examination, we must stop our haphazard hunting for areas where the explorer catches in enamel and substitute a thorough search for the signs of the carious process. What a different mental and physical equipment the latter method requires!

The mouth mirror and explorer are no longer the all-important principals. They are surpassed in importance by an inquisitive and keen intelligence that uses them and many other aids in a quest for discernible changes in tooth substance. The scientific operator will look for cavitation associated with débris, loss of translucency, loss of hardness and discoloration instead of "catching" surfaces.

This broader concept of mouth examination for carious lesions requires an enlargement of our armamentarium. Two mouth mirrors, one plain and one magnifying, are useful. Several sharp explorers of varying designs are necessary. These should be augmented by three or four small smooth broaches that may be bent to fit areas difficult of access. The rubber dam or cotton rolls are indispensable, for it is impossible to detect small lesions when the teeth are wet. Dental floss and a separator are helpful during the examination of approximating surfaces. Roentgenograms, preferably bitewings, are extremely valuable. It is obvious that a thorough prophylaxis should precede the examination. If enough bleeding to obscure tooth surfaces follows the prophylaxis, the examination should be postponed.

The problem of illumination deserves special mention. As normal enamel and dentin are very translucent, we should include in our equipment an intra-oral light for transillumination of tooth substance. Good direct light is essential. The direct light should deliver approximately 50 foot candles at the head rest. It should illuminate the entire working area. Lights producing more than 50 foot candles at the headrest or lights confined to a small spot accentuate shadows and reflections to a degree that interferes with accurate diagnosis. Less than 40 foot candles at the headrest is insufficient for good visibility.

In view of the fact that macroscopic cavitation follows microscopic, it is best to begin the examination of each tooth by looking for a loss of translucency of enamel and dentin. The tooth must be dry. Light should be directed through the tooth substance, and then directly against the tooth surface. Loss of translucency is evidenced by a dark shadow in contrast to the normal color during transillumination. In other words, transillumination results in a picture similar to that seen in a roentgenogram. Loss of translucency is seen as a dull, flat white, opaque area under direct light. A loss of translucency alone is not always indicative of the presence of a carious lesion. Any change in light transmission requires digital examination.

During the examination for loss of translucency, one should be extremely careful to locate and investigate all areas that are common sites of plaques or carious lesions. This is done with the aid of explorers and mirrors. Exceptional care should be used to determine the quality of all enamel that exhibits changes from the normal. The sign that is most reliable in this respect is the loss of hardness that accompanies the progress of the carious lesion. Explorers catch readily in any developmental pit or fissure of proper size. The enamel, if carious, will be softened to some degree. This softening is felt by guiding the explorer point along the

enamel surface. Soft enamel will admit the point readily. Withdrawal of the point reveals a sticky softness corresponding to the sensation one experiences in withdrawing a needle from a cork. Smooth broaches are particularly useful for examining the enamel surface in small pits and fissures. They are also helpful just below and around the contact areas. If the tips are bent to the right degree, it is possible to feel the surface of most of the enamel in this position. The fact that enamel is destroyed gradually by the carious process is of diagnostic significance. The loosened rods and the partly softened material feel sandy or gritty when the explorer is wiggled gently in a pit or on a carious surface. In view of the fact that we seldom find sandy or gritty material in the normal mouth, this sign carries considerable diagnostic significance.

Comparatively large lesions usually exhibit macroscopic cavitation. There are times when the opening in the enamel is comparatively small, while the destruction of dentin is massive. One frequently encounters this condition on the proximal surfaces of teeth with comparatively small contact areas. These cavities are revealed best by transillumination. They are not always evident in a roentgenogram. One may verify their presence by using the explorer or a smooth broach. The point of the instrument is inserted in the orifice of the cavity. If the opening is near the contact area, a smooth broach will be the instrument of choice. After the point drops into the cavity, the instrument should be manipulated gently in three directions, gingivally, buccally and lingually. One should be able to feel all three walls of the cavity. Movement toward the contact area is apt to be deceiving as the instrument will wedge in the narrow part of the embrasure. Gentle manipulation of instruments gives far more gratifying results than the use of considerable force. We can feel a hair on the face if we feel gently. The use of force obliterates the delicate responses.

Discoloration and pain are the least reliable of the diagnostic signs of dental caries. The skill of the operator in the art of history taking and the accuracy of the patient's interpretation of symptoms determine the significance of pain as a diagnostic factor.

Discoloration is a sign that accompanies slow progress of the carious lesion. It must be interpreted with skill and understanding. Lesions that progress slowly may result in pulp exposures before the enamel surface is destroyed to the point where it will readily admit an explorer. Such lesions are seen on transillumination as dark brown areas that interfere markedly with the transmission of light. Under direct light, the brown stain may be seen through the normal translucent enamel and dentin. The enamel of the marginal ridge is an exceptionally favorable place to observe changes on proximal surfaces.

Discoloration about amalgam fillings often misleads the examiner. Amalgam is light gray, but may darken with age. The carious process renders enamel nontranslucent, opaque and flat white. As long as one can clearly discern the color of amalgam through highly translucent enamel, the degree of blackness is no indication of the presence or absence of a carious lesion. The color may be due to treatment of the tooth with silver nitrate. If the enamel appears translucent in the outer portion and white and opaque adjacent to the filling material, dental caries is almost invariably present. There are few dental cements that have the same color as carious enamel. A little practice will render any operator capable of making this differentiation. Silver nitrate, amalgam or dental cements do not interfere with the normal translucency of enamel; dental caries does.

The principles that have been applied to the problem of mouth examination in the foregoing discussion are equally valuable in the examination of roentgenograms. In addition to a thorough knowledge of the pathogenesis of the carious process, a complete understanding of the physical laws governing the production of roentgenograms is necessary. It is advisable to postpone examination of diagnostic films until the oral examination is completed. An element of human interest is added to our work when we use the roentgenogram to check accuracy in oral examination. One encounters many instances in which the oral examination will reveal the presence of carious lesions more accurately than the roentgenographic one. This fact should not discourage us in our use of roentgenograms, for the reverse of this situation is frequently encountered. The conscientious operator will do his best to use all available means at his disposal intelligently.

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HOW THE GENERAL PRACTITIONER CAN SOLVE THE ORTHODONTIC PROBLEM

By EDWIN J. BLASS, D.D.S., Portage, Wis.

IN nearly every town and small city in this highly enlightened country, we find practitioners of law, medicine and dentistry who serve clients and patients with all the skill and intelligence comparable to that enjoyed in the metropolitan centers. Likewise, the enrolment of technical schools for boys and finishing institutions for girls is largely made up from outside the large cities, and the graduates from these educational centers return to the environments in which they were reared to continue their lives. There, where the field is fertile, the neophyte professional graduates demonstrate the product of their college training by practice and constant progress toward higher ideals and standards.

The specialist is the product of the larger city. This appellation, however, which implies a concentration on one phase of professional practice, does not always indicate the acme of technical skill. Theoretically, the specialist should be able to render a more nearly complete service than one who undertakes to cover the entire field. However, we find graduates with their sheepskins hardly dry announcing to the public a practice limited to exodontia, orthodontia or some phase of practice. There appears to be no legal objection to any one's proclaiming himself a specialist, provided he possesses the necessary degree and the license to practice.

Surgery, involving all types of simple and complicated operative procedures, is practiced daily by thousands of general

practitioners of medicine. This is as it should be; for, to the average citizen of farm and town, no other avenue of hope for correction is available. Do we hear rumblings of despair or admonitions of "Don't do it" when the majority of physicians who are not specialists operate upon those in need? Who then has the right to question a general practitioner of dentistry if he sees the need for and decides to include an added phase of his profession in his daily practice?

The deep secret of orthodontia that we are led to believe is so shrouded by dangerous potentialities that the general practitioner must not touch it is none other than a plan and technic for correcting malalinement of the teeth. Granted that this particular procedure does involve intricacies beyond the use of arch bars, bands and ligatures, it is still my conviction that a dentist's profound study of the field of his profession and his knowledge of the anatomy of the dental arches and the structures involved qualify him to formulate and carry into execution the steps necessary for corrective measures.

Tremendous obstacles, wrecked mouths and dismal failure are pictured to dentists who decide to accept the challenge and begin the initial case. One cannot walk till he crawls, and likewise one cannot build a house till he starts at the foundation. It is unnecessary and impractical and will never serve the purpose to advise and demand that, before one endeavors to correct malocclusion, he first take postgraduate work. This is just as inconsistent as a contention that a dentist must supplement the D.D.S. degree with postgraduate work before attempting an alveolectomy or before placing his hand upon the lever of an x-ray machine, with its injurious possibilities. Incompetent and careless operators should receive professional attention, but specific restrictions upon any particular performance that is included in one's profession cannot be accepted by general practitioners.

Is it not possible, or is it at all unlikely, that the operations performed by physicians are not all entirely successful? Sincere physicians, who give their best, are seldom criticized for failures, nor are they belittled when their technic is not quite so excellent as that of specialists. Is it fair to discourage a general practitioner of dentistry for attempting to change a smile of repugnancy to that of beauty when the need is most apparent and the patient has no possible access to a specialist even though he desired one? Let me emphasize this statement: The dentist's initial corrective case will suffer no greater degree of failure than will that of a surgeon who wields the knife when first he dons the operator's gown.

What I, with my humble degree of efficiency, have been able to do in the way of rendering assistance to those in need, others of the profession can do as well or better. To the general practitioner who appreciates the tremendous need and has the desire and will to do, I suggest this field where the harvest is great and the workers are few. I am basing my contentions and recommendations on a personal experience of more than twenty-five years. Beginning, as I did, with far less training than is accorded the graduate today and relying solely on the then none too efficient commercial laboratory to construct the appliance step by step, I succeeded with my first case in transforming a "buck tooth" individual to one normal in appearance. Today, the highly efficient laboratory which fills my prosthetic needs also builds my orthodontic appliances, better and cheaper than I can. In charge of this laboratory's orthodontic department is a graduate dentist, skilled and qualified to build appliances and give advice to the beginner.

Just a general practitioner in a town of 6,000, I can point with pride to scores of "before and after" models of cor-

rected dental arches. Appreciating the fact that I am catering to those who find it too expensive, too inconvenient, if not utterly impossible to contact specialists, I feel satisfied that no one, regardless of position, could have grounds for criticizing, nor would he have any desire to criticize, my efforts. The gratification of the parents for what I have done for their children has been a greater compensation to me materially and mentally than that of any other dental service that I could possibly have given.

I am making no attempt at self-glorification: I realize only too well my limitations. However, by constant practice, diligent perusal of books on the subject and advice gleaned from others, I have naturally improved in ability. Problems are constantly arising that cause me to feel that the subject will never be mastered, but one must forever keep plodding onward. We must not be daunted by difficulty, but must accept every case, from one that responds to the use of a simple incline plane to the mouth bereft of all semblance of a normal one.

As important as ordinary dental procedures on children's teeth are, every dentist has had adult patients possessed of excellent teeth even though their temporary ones were broken down and decayed and were never given dental attention. When a malformation of a child's mouth is left uncorrected, he will manifest a distressing facial deformity during the entire life of the retained organs of mastication. Bridgework and dentures are resorted to in an attempt to correct a deed of omission, but the natural facial beauty is lost beyond recall for the reason that orthodontia was not resorted to in early life. Perchance the general practitioners of the children in question were admonished to steer clear of orthodontia.

There is a solution for this problem: It can be proved by a dentist who has the qualification of patience, the willingness to study and the love of children. Try this simple formula: For your first step, accept a case that appears not too complicated. Then submit models of the arches together with x-ray films of the complete mouth to a dental laboratory competent to accept such cases. They will advise you as to what to do step by step, and then construct the necessary appliances. If such initial efforts of yours are rewarded with some degree of success, which I have every reason to believe they will be, you will be spurred on to greater heights. Nothing but progress gained through study of books on the subject and postgraduate work will satisfy your ambition for a complete prosecution of this intensely worth while service.

The practice of orthodontia stands preeminently as one of the most beneficent services that dentistry offers the public today. The value of the results of this transformation technic cannot be estimated in dollars and cents.

As a sculptor pictures his model from a mass of clay to the finished product, so we as dentists should accept misshapen mouths, form a mental picture from this clay of discord and use the knowledge our education has given us to effect a happy smiling countenance, a transformed mouth.

What Darwin said many years ago is true today: "Man was made to be well and perfect. Regardless of what hindered that plan, it is your duty and it is mine to do all we can to establish the fact."

Graham Block.

PROSTHETIC DENTISTRY IN THE UNITED STATES NAVY

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THE national emergency has added to the interest in the functions and intricacies of the armed services of the nation. Because of the similarity of endeavor, the interest of the civilian dental practitioner in the Naval Dental Corps has likewise increased. This interest is attested by the greater number of inquiries that dental officers of the Navy receive from their civilian confrères.

Every effort is made to obtain the best possible dentists for the Navy, which has much to offer in return for high professional qualities. Competitive entrance examinations result in our securing, on the whole, dental officers of ability and high ideals. In every case in which these qualifications are exhibited, the benefits derived from membership in the American Dental Association are definitely recognized. To the naval dental officer continually interested in professional advancement, the American Dental Association membership card is, in his travels, the key to invaluable professional contacts and learning. The benefits derived on every hand from the civilian practitioner are deeply appreciated, and it is hoped that this paper and the findings subsequently mentioned will create an enduring interest, afford a better understanding and convey the sincere desire of the Naval Dental Corps to contribute its part to the profession at large.

There are 327 dental officers on the active list of the Navy. This includes twenty-eight reserve officers now on active duty. The present law allows one dental officer to each 500 of the actual strength of the Navy and Marine Corps, but as we must render professional service to the retired list as well as certain other supernumeraries, one can readily see that this is not a true picture. This number has been further altered by the recent increase in personnel occasioned by the National Emergency Proclamation.

Upon successfully completing the entrance examination, dental officers are usually sent to the Naval Dental School, Washington, D. C., for a four-months' period of indoctrination and postgraduate instruction. From there, they are assigned to one of the Navy shore stations for a year or more, after which they are ordered to a ship or one of our foreign shore establishments.

At present, there are 100 dental officers in eighty ships, plus twenty-eight on the Asiatic Station and other foreign shore duties, making a total of 128 on sea or foreign shore service. The number of ships in commission is slightly under 500; hence, it is evident that many ships do not have a dental officer, while one has as many as three. The hospital ship, *Relief*, has three dental officers; whereas the large plane carriers and tenders, as well as the *Utah* and *Medusa*, have two each. Other ships which have dental service carry but one dental officer.

Professional service at most of the naval shore stations embraces every phase of dentistry, with the exception of orthodontia. Dental officers are usually assigned to stations that afford the greatest opportunity for the application of any special ability that they may possess.

Professional services of a dental nature on board ship are limited, generally

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speaking, to amalgam and silicate restorations, root-canal treatment, extractions and minor oral surgery, prophylaxis and dental and medical x-ray examinations. Should bridgework or full or partial dentures be required for a patient, the mouth is first placed in condition to receive the type of prosthesis indicated and a request submitted to the Bureau of Medicine and Surgery for approval. When approval is obtained, the patient may, at his earliest convenience, present it to one of the ships or shore stations having prosthetic facilities.

Dental officers of the Navy, both at sea and ashore, enjoy the same privileges as other staff or line officers of equal rank. The tenure of office in the Dental Corps is for life, unless terminated by removal, resignation, disability or failure to be selected for promotion. The annual pay and allowances, upon appointment, amount to $2,699 for an officer without dependents and $3,158 for an officer having dependents. The maximum salary attainable, including allowances, is $7,200 annually. Dental officers may retire after thirty years' service, at the discretion of the President, or at the age of 64 with three-fourths of the pay of the rank held by them at the time of retirement.

The Naval Dental Corps was organized in 1912, and prosthetic treatment was instituted in 1922. At the time of its introduction in the Navy, dental prosthesis was limited to the simplest type of appliance that would satisfactorily replace teeth that had been lost in line of duty. The scope of prosthesis is much broader today, including every type of restoration known to dentistry. The necessity of replacement for oral and general well-being is now the determining factor, and the type of treatment instituted is left entirely to the discretion of the dental officer to whose care a patient is entrusted. Naval personnel, regardless of rank or rate, are accorded the same consideration in the endeavor to restore proper masticating function.

There are twenty-two prosthetic facilities in the Navy at present. Of this number, fifteen are on shore stations within the continental limits of the United States; three are afloat, on the ships *Medusa, Utah* and *Relief;* and the remaining four are in the foreign shore establishments at Shanghai, Canacao and Honolulu and in the Canal Zone. There are thirty-two dental officers assigned to the prosthetic service at these facilities. The number of cases awaiting treatment at all establishments is 650, and the average number of cases completed each month is 350.

All major supplies and materials are obtained through competitive bidding and are retained at the Naval Medical Supply Depot, Brooklyn, New York, until such time as they are requisitioned for use by dental officers at the various activities. Special items, not on the supply table, that may be required are obtained by open purchase through an annual allotment for that purpose. Supply table items, including precious metals, are required to meet certain specifications submitted to manufacturers desiring to bid. These specifications, written to secure products suitable for use in distant parts of the world, and the ability of the materials to meet them, are determined through cooperation with the Bureau of Standards. Naval dental officers are assigned to this bureau from time to time for training in the methods of testing the various materials used by the Dental Corps. Newly developed materials are also sent to the Naval Dental School for practical application to determine their worth.

Dental officers especially interested in and qualified to do prosthetic work are listed as specialists in this field. Every effort is made to assign these officers to ships or stations that have prosthetic facilities. Officers with special aptitude and ability in any phase of dentistry are encouraged and afforded opportuni-

ties for postgraduate instruction at leading universities. An average of six officers are permitted full time postgraduate courses each year. These courses vary from two to six months and may be longer in special instances. In the armed services, however, where a periodic change of duty is required, overspecialization is frowned upon. It is paramount that an officer be able to fill another officer's place in the broadest sense of the term.

Prosthetic laboratory work in the Navy is largely entrusted to members of the enlisted personnel, who are trained and supervised by dental officers. These men receive a dental assistant's training at the Naval Dental School and, upon satisfactory completion of the course, are given the special designation of general dental technician. Those, in turn, who desire to specialize in prosthetic laboratory work are granted an additional four months' instruction in this field and then assigned to a prosthodontist for further practical learning, with the designation of dental technician, prosthetic. These classes are held at the Naval Dental School, Washington, D. C., Naval Hospital, Portsmouth, Va., and Naval Hospital, San Diego, Calif., from which an average of twelve technicians are turned out annually. The present method of assigning prosthetic technicians to the different dental officers is considered to be more satisfactory than the establishment of one large central laboratory.

The various prosthetic technics employed in the Navy differ with the individual. No restriction is placed on the type of treatment instituted or the technic used. Application of the most practical method that will afford the greatest good for the greatest number is, naturally, essential. Universally accepted practices and materials are stressed to some extent for reasons of distant repair and uniformity of equipment. However, there are no hard and fast rules, and entrants to the Dental Corps retain their individuality in the employment of whatever technics they prefer.

Dental officers interested in research receive all possible cooperation. Individual initiative in this field is continually fostered, and such work may be carried on wherever facilities are considered suitable. Research projects in preventive dentistry, therapeutics, dental histology, blood chemistry, dental illumination and various phases of prosthesis have been undertaken. Reports of certain worth while findings may be found in recognized dental literature. Others will be mentioned later. The necessity of periodic transfers in the Navy interferes with extensive and prolonged research. However, increased facilities for research are to be established at the new Naval Medical Center in Washington, where officers with special problems may be assigned.

I have done work on certain prosthetic materials and the development of improved technics in the construction of different types of bridgework, which comes under the scope of prosthesis in the Navy. The desirability of the dentist's utilizing various formulae for the efficient conduct of his office is generally recognized. Certain formulae in this regard, as well as technics of special practical interest, will be mentioned here to the extent that time will allow.

The removal from the market of the acrylic resins in powder and liquid form was a definite disappointment to the naval prosthodontist. As this material often had to be sent to points as far distant as China, and because a large part of its travel was via Navy transport through tropical climates, it was often found, on its eventual receipt, that the ready mixed product had been cured in the vacuum containers. Inquiries made of the manufacturers as to the reason for use of a ready made mix were not sufficiently convincing, but efforts to obtain the separate monomer and polymer were without success. As the methyl methacry-

late monomer was not available on the open market, experimentation with the use of monomeric styrene as a substitute was undertaken, leading to some interesting and satisfactory results. Some pioneer work in this field has been done by M. D. McKenzie, of the School of Dental and Oral Surgery of Columbia University, and he has been most generous in his assistance.

Monomeric styrene, when mixed with hard, fine powdered methyl methacrylate polymer or lucite in the proportion of 1 part of powder to 3 parts of liquid by cubic centimeter measure, and properly cured, affords a plastic material with varied dental uses and at nominal cost. It is well suited for the making of temporary bridges, impression trays and pins in tube teeth in waxing up full-cast partial dentures, as well as in other conditions in which any plastic material might be employed, such as orthodontic retaining appliances and fracture splints.

The use of monomeric styrene and methyl methacrylate polymer as a full and partial denture base material has proved satisfactory in more than twenty cases over a period of from six to eighteen months. Numerous laboratory test cases have shown accurate model adaptation with no measurable change over the same period of time. The chemistry involved in the use of the styrene monomer is different from that of the methyl methacrylate monomer. Methyl methacrylate monomer and polymer result in a final single substance; whereas, when monomeric styrene is used, the resultant product remains two substances, which combine, with the styrene as the binder, in a satisfactory compound for the purposes intended.

Monomeric styrene can be purchased from the Bakelite Corporation at approximately $1 a pound. It is obtainable either with or without a stabilizer. Monomeric styrene without the stabilizer is also known as Bakelite XRS-11678. Bakelite XRS-12471 is monomeric styrene stabilized by the addition of 0.05 per cent of hydroquinone. The addition of hydroquinone inhibits the spontaneous polymerization of the liquid and increases its keeping time to six months or longer at room temperature. As the hydroquinone has no deleterious effect in the use of this monomer as a denture material, it is recommended because of its greater shelf life.

Hard, fine powdered lucite (methyl methacrylate polymer) can be obtained from the Dupont Company at approximately $1.25 a pound. It has been stated that lucite powder so obtained contains certain impurities which are harmful to the oral tissues and which are not found in various denture materials on the market, but this has not been borne out in its practical use. The lucite powder and monomeric styrene liquid can be combined without the addition of coloring matter for various purposes previously mentioned; or coloring matter may be added and processed into dentures, etc., in the following manner:

Four hundred milligrams of English quicksilver vermilion and 250 milligrams of English vermilion, pale shade, are added to 5 gm. of zinc oxide powder, triturated thoroughly with a mortar and pestle and sifted. One gram of the resultant mix is then added to 80 gm. of hard, fine powdered lucite and completely mixed, again with mortar and pestle. It is essential that the coloring powder and lucite be triturated thoroughly and that care be exercised in preventing any foreign matter from entering the mix, in order that the processed dentures shall be evenly colored. Failure in this respect will result in dentures with a speckled appearance; whereas cleanliness and proper mixing will produce a material that is very well suited to the majority of cases. It is possible to alter the shade of this material most satisfactorily to match the complexion by merely varying the proportion of pigments or the amount of

zinc oxide coloring that is mixed with a given amount of powder. For example, a denture material that is somewhat lighter in shade and admirably suited to a certain type of normally pale individual can be obtained by adding 50 mg. of the above-mentioned zinc oxide coloring to each 5 gm. of lucite. Also, a color that may be very pleasing to some can be obtained through the use of but one pigment by adding 900 mg. of English quicksilver vermilion to 5 gm. of zinc oxide and 50 mg. of the resultant mix to every 5 gm. of lucite powder used.

It should be mentioned that a variation of color in the processed dentures may result in the experience of different dentists following the same instructions, but using pigments purchased from different companies. This is due to the fact that pigments with the same name put out by different manufacturers often vary in shade. It seems imperative, therefore, that the place of purchase of the above-mentioned pigments be given. The English quicksilver vermilion was obtained from Eimer and Amend, wholesale druggists, 3rd Ave. and 18th St., New York City. A uniformly desirable English vermilion, pale shade, was obtained from Devoe and Reynolds paint stores. Suitable results can be obtained through the use of insoluble pigments which may vary slightly from those used by me and which may be preferred for the convenience of local purchase, but experimentation with varied proportions of the pigments will be necessary.

In processing this material, the case should be waxed and flasked in the manner usually employed for vulcanite. Both sides of the case should be tinfoiled for best results, although foiling is not absolutely necessary if the case is to be processed in boiling water. Twenty-one cubic centimeters of the colored lucite powder is placed in a porcelain container, such as a common salve jar, and 7 cc. of styrene liquid added. This is sufficient material for the average lower case, and 27 cc. of powder and 9 cc. of liquid are required for the average upper case. More, in the proportion of 3 parts powder to 1 part liquid, may be mixed if required. The ingredients are mixed thoroughly with a stainless steel spatula and the open jar is placed in warm water until the mass has set to a fairly stiff, cheeselike consistency. The mix will be noticeably sticky at this point, but this can be largely overcome and ease of handling be facilitated by rolling the mass into a ball between the palms of the hands and shaping so as to fill the flask. While the flask is still warm, but not hot (110-120° F.), the mix is placed in position, slightly in excess of requirements, and covered with moist cellophane and the flask closed slowly in a press. The flask is separated and the cellophane removed. The latter may again be moistened with cold water to facilitate removal, and all excess material is cut away from the periphery of the case. The flask may then be closed completely and the case processed in a vulcanizer for thirty minutes at 240 to 250 degrees F., or in boiling water for forty minutes. On removal, the case should be permitted to bench cool for about ten minutes and then should be immersed in cold water until cold throughout. The possibility of checking of teeth resulting through the processing of this material can be prevented by allowing space equal to the width of a thin razor blade between all porcelain teeth in contact with one another. The general procedure of processing is not unduly exacting, and the ultimate cost of the material is negligible.

This material is well suited for impression trays for the taking of muscle-trimmed impressions. For this purpose, the plain uncolored powder can be used. It can be processed in the vulcanizer or by boiling, as described above, or by the employment of a very simple technic of curing under dry heat. In using the dry

heat method, a suitable tray can be obtained in a minimum of time and with little effort, as flasking of the case is not required. The simplicity of making an impression tray by this method fills a definite need in dentistry.

The procedure is as follows: A regular shellac baseplate, upper and lower, is covered on one side with a sheet of 22-gage wax, and the whole invested in stone between the two halves of a regular vulcanite flask. After the stone has set, the flask is separated and the baseplate and wax are discarded. A mix of 24 cc. of lucite powder and 7 cc. of styrene liquid is then made in the manner previously described. Moist cellophane is then placed over the void created in the lower half of the flask by the previously invested baseplate. The ball of mix is placed in the center of the void and covered with cellophane, and the flask is closed in a press. The flask is then separated and the baseplate-shaped mass removed. The cellophane is again moistened with cold water and one sheet and all excess material are removed. The remaining material is then inverted and adapted to the snap impression model, which has been previously tinfoiled, in much the same manner that a softened shellac baseplate is adapted. The remaining sheet of cellophane is then removed and the excess material shaped properly and pressed into the material covering the anterior ridge to form a handle for later use.

Moist cellophane should be used in adapting the material throughout to prevent it from sticking to the fingers and pulling away from the model. Upon proper adaptation to a fairly uniform thickness, the case is placed in an empty 10-pound plaster can in which a 60-watt light bulb has been inserted from the bottom. The can is placed on its side and the case beneath the light and the can is closed and allowed to remain for twenty-five minutes or longer. Upon removal, it is permitted to cool for a few minutes, then the tray is removed and trimmed as desired.

This method can also be employed in the making of special trays for partial denture impressions when an elastic impression material is used. In this case, a snap compound impression is taken, which includes all remaining teeth and edentulous areas that are to be included in the final impression. The model having been poured, the areas where teeth are present are built up with plaster and shaped to the form desired for the inside of the finished tray. The model is then tinfoiled and plastic material adapted. A handle can then be shaped out of any wire that is strong enough to resist bending easily and the base of the handle is pressed into the plastic material covering the anterior part of the model. After curing, numerous holes can be drilled in the resulting tray to retain the impression material in position. Plaster of Paris is suggested for all models used in this technic to facilitate removal of the cured tray from possible undercuts.

This material can also be used to advantage in the waxing of full-cast partial dentures when tube teeth are employed. Difficulty has often been experienced in the past in placing the tube teeth back on the finished casting, because the 14-gage wax used to form the posts that retain these teeth becomes bent or otherwise distorted during the process of investing the case. Trouble has been encountered also in properly tacking the wax inserts (posts) to the wax covering the ridge. These difficulties can be readily eliminated by using 14-gage round forms made of this plastic, as follows: Two flat pieces of brass about 2 inches square and heavy enough to resist bending are firmly clamped together and several 14-gage holes drilled directly between them. A mix of the clear powder and liquid is made in the usual manner and placed between the two plates. The plates are then pressed

together firmly and held in this position and placed in boiling water for fifteen minutes or longer. The resulting 14-gage sticks can be cut to the desired length, inserted in the tooth and pressed firmly to place against the ridge. Cutting the sticks with a safe-side disk results in a fraying of the periphery. When the post is pressed to place in the tooth, this frayed edge will dig into the wax covering the ridge and hold the post firmly in position when the tooth is again removed prior to investing the case. If the case is burned out in the usual manner, all trace of the plastic material will be eliminated with the wax and will in no way interfere with the final casting.

More extensive use of this type of plastic material in dentistry may be expected in the future. Its ease of manipulation and susceptibility to various colorings has suggested its use in certain types of operative restorations, but further work in this field is necessary to determine its true worth. The use of this material for the construction of anterior immediate temporary bridgework, however, has been most gratifying and warrants mention at this time.

When an immediate temporary bridge is desired, preparation of the abutment teeth is completed and an impression taken with an elastic or any other suitable impression material and poured in stone. Vulcanite pin teeth are then adapted to the case and waxed to the preparations. The case is then invested in the manner usually employed for partial dentures. If both sides of the case have been tinfoiled, it is processed with clear lucite and styrene in the vulcanizer for thirty minutes, or if tinfoiling has been omitted, it is placed in boiling water for forty minutes. Should time be an important factor, satisfactory results can be obtained without investing the case and curing with dry heat. In the latter case, a plaster-of-Paris splint is used to hold the vulcanite teeth in place and the pins and abutment preparations are covered to moderate excess with plastic and cured in the manner employed in making impression trays by the dry-heat method.

Satisfactory results have been obtained in taking impressions for immediate bridgework, as mentioned, as well as for partial dentures, with an elastic impression material that is made according to the following formula.

Agar flakes, 2 ounces; zinc oxide, 2 ounces; water 500 cc.; one-half Kotex, regular (cotton-like filler only), and vermilion, 3 gm., are placed together in a double boiler. The boiler is covered and the ingredients are allowed to cook for about one-half hour, after which the mix is stirred well at intervals of ten minutes or so, until it has cooked for approximately one hour in all. A few crystals of menthol are then added and the whole stirred until evenly mixed. The material is now forced into any smooth metal tubing with an inside diameter of fifteen-sixteenths inch and 4¼ inches in length. After being filled, the tube is immersed in cold water until the material is thoroughly chilled, when it can be ejected and kept in a moist jar (not in water) until needed.

When use of the material is required, a stick is placed in a mixing syringe and boiled for four minutes. The syringe is pumped in tepid water until merely warm. Then the material can be placed in a water-cooled tray and the impression proceeded with in the usual manner. In the event a syringe is not available, a large sausage-shaped toy balloon may be substituted. It will be noted that this impression material possesses more body than most similar materials on the market. This additional bulk reduces its flow at the temperature at which it is normally used and facilitates the placing of a larger amount of material in those areas of the tray where increased extension of the impression is desired. It is due in part to the use of a minimum of

water in the formula. Should a more freely flowing material be desired, as in duplicating procedures in the laboratory, it can be obtained without sacrifice of accuracy by merely adding a small quantity of water.

The accuracy and cost of this material is dependent almost entirely upon the type and quantity of agar-agar purchased. The use of a high grade agar-agar is essential. It is also essential that flake or strip agar-agar be used, as the powdered form is entirely unsuited for the purpose. U.S.P., as pertains to agar-agar, refers primarily to the absence of any harmful ingredient when it is used medicinally and does not refer to its inherent elasticity when used as an impression material. For this reason, it is possible to obtain a U.S.P. agar-agar that may not be suitable for impression purposes. I have obtained satisfactory results whenever the best obtainable grade of agar-agar, purchased from various reputable pharmaceutic houses, was used. The results obtained through the exclusive use of this material by one of our leading universities has borne out these findings. As the agar-agar is also the most expensive item in this formula, the quantity purchased at a given time has a definite bearing upon the ultimate cost of the material. The cost diminishes considerably with an increase in volume purchased, and, if it is acquired in pound lots, the cost per impression is very small.

Results previously unattainable in certain types of fixed bridgework have been made possible through the use of the recently marketed low-fusing (1600° F.) porcelains. A technic for the construction of solderless bridgework which permits the fusing of this porcelain to the commonly used golds has given very satisfactory results.

SUMMARY

The Naval Dental Corps endeavors to obtain the highest type of dentists, who in turn are reminded of the benefits to be derived from close cooperation and contact with civilian dental groups. Benefits derived from such contacts in the past are sincerely appreciated. There are 327 dental officers in the Navy. The law permits one dental officer to each 500 of active personnel, but the rendering of dental service to retired personnel, as well as other supernumeraries, considerably alters this ratio.

Dentistry in the Navy embraces every specialty in the profession, with the exception of orthodontia. Postgraduate instruction at leading universities is afforded dental officers with special aptitude and ability. Overspecialization is frowned on, for the ability of one officer to replace another officer is paramount.

The Naval Dental Corps has much to offer in return for desirable professional qualities.

Prosthetic treatment was instituted in the Navy in 1922. Prosthetic replacements are determined by their necessity for insuring health. While necessary periodic transfer of dental officers interferes with prolonged research, varied research projects are undertaken in an effort to contribute to the general good of the profession. The desirability of the dentist's utilizing various formulae for the efficient and intelligent conduct of his office is stressed.

Employment of a formula for a plastic material in a variety of technics has had gratifying results. This material has almost unlimited possibilities in the dental field. Technics in which it can be conveniently employed with worth while savings are given. Elastic impression material can be easily made and excellent results obtained.

Yard Dispensary, Navy Yard.

Note. The opinions or assertions contained in this article are the private opinions or assertions of the writer, and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.—Article 113, U.S. Navy Regulations.

INDICATION FOR PHYSICAL THERAPY IN ORAL DISEASES

By MAURICE WEISBLUM,* M.D., Philadelphia, Pa.

IT is little realized what beneficial effects may accrue from the application of physical therapy to certain organic oral lesions. It will be my purpose in this presentation to acquaint the dentist and the physician with the indications and methods of application of valuable physicotherapeutic procedures, employed alone and as adjuncts.

We have found physical therapy to be of use in the following diseases: neoplasms, malignant and benign, hemangiomas, cysts, chronic ulcers, aphthous stomatitis, pyorrhea, pemphigus, actinomycosis, cellulitis, adenitis, osteomyelitis and periostitis, facial neuralgia and facial palsy.

Neoplasms are found frequently on the mucous membrane of the cheek, gum, tongue and lips, the papilloma, either flat or pedunculated, being the most common. Cysts and hemangiomata are usually found on the mucous surface of the lower lip. Verrucae, especially in children, occur on the skin of the lips. We believe that these warts are infectious and are transplanted from the fingers, where they make their initial appearance. I have never seen a verruca of the lip on a child who did not have a similar lesion on the hand. Epulides, which resemble papillomata, appear on the gum between the teeth, grow rapidly and have a tendency to recur without adequate treatment.

Malignant growths are found in the body of the tongue, occasionally on the side and tip, on the buccal mucous membrane and more frequently on the lower than the upper lip. The predisposing cause is irritation from a jagged tooth, the rough edge of a plate, an old clay pipe, tobacco juice and smoke and occasionally a burn from hot food. The actual cause, of course, is unknown, but it is my opinion that a weak microorganism or parasite is the causative agent, and that every malignant growth is primarily a local lesion, which can be completely eradicated provided treatment is instituted early and the neoplasm is entirely extirpated in one operation. These lesions are diagnosed by their appearance and history, by blood test and by biopsy. Transillumination and the x-rays are employed for early diagnosis in cases of intraparanasal sinus and antrum neoplasms.

In treating small benign growths, we commonly employ the desiccating current, a uniterminal current obtained from the solanoid winding of the high frequency machine. It produces a minimum of scar tissue and does not penetrate so deeply as the biterminal current. This uniterminal current is called the Oudin current.

The d'Arsonval, or biterminal, current is a thermocoagulating current used in treating both malignant growths and large non-malignant tumors. This current is far more powerful and more penetrating than the uniterminal current.

It is essential to destroy the malignant neoplasm in its entirety at the first attempt, as there will be a rapid spread of the growth if any neoplastic cells remain. It has been our practice to destroy an

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area one-half inch wide around the growth to close all the channels by which cancer cells may travel through the system and to destroy any extensions into the surrounding tissue. A one-stage operation gives the best results. It is much better to destroy too much than too little tissue.

I wish again to emphasize the great importance of early diagnosis and of thorough and complete destruction of the malignant growth in one operation. Ordinarily, this treatment suffices for a cure.

In treating extensive malignant growths in the body of the tongue, destruction by the thermocoagulating current is followed by implantation of radium needles along the periphery of the tumor, which are left in the tissues for from twelve to twenty-four hours. This procedure may also be required in treating extensive growths in other parts of the mouth.

The intensity of the current and the duration of the application are determined by the size and depth of the neoplasm. The proper dosage and technic for each case can be determined only by practical experience.

Cysts and hemangiomata, which appear most frequently on the lips, are destroyed by the thermocoagulating current, under local anesthesia. The cosmetic effects are uniformly good. The *modus operandi* is as follows: A large flat copper or tinfoil plate is connected with one terminal of the high frequency machine and placed either on an extremity or on the spine. This is the inactive electrode. The active electrode (the one used to destroy the growth), a needle-shaped piece of aluminum, is connected with the other terminal of the machine. It is important that the inactive electrode be in close contact with the skin, to prevent sparking and blistering. The active electrode is held against the neoplasm until, in the judgment of the operator, the growth is completely destroyed. The needle is never introduced into the growth. Whenever possible, this operation is performed without a local anesthetic in order to minimize the danger of metastasis. The results are very gratifying in the early cases, with more than 90 per cent cures.

Thermocoagulation possesses many advantages over the use of the knife and the cautery. It is a simpler method; it appears to have a selective action on the diseased cells; it requires no suturing; it results in fewer deformities; it produces a sterile wound; there is little hemorrhage when the slough separates, and, most important of all, it gives the large number of permanent cures.

Diathermy is a useful adjuvant in the treatment of osteomyelitis and periostitis of the maxillary bone. The d'Arsonval current raises the temperature of the bone and contiguous tissues, producing an active hyperemia. Consequently, it often aids in arresting the infection and in hastening resolution. A current intensity of 400 ma. will suffice. Electrodes 3 by 3 inches are placed on each side of the face, with the lesion between the electrodes. One must guard against burns from applying the electrodes in close contact with the skin. We prefer the old conventional high frequency current for this work. In our experience, diathermy produced by the longer wave or conventional high frequency has given better results than the short wave current. At least 3,000 treatments were given in our department at the Mt. Sinai and Philadelphia General hospitals, with various short-wave machines, during a period of four years. Severe burns have resulted from the improper application of diathermy with the short-wave current, and I know of two deaths from its use in electrosurgery.

In order to apply ultraviolet and infrared rays efficiently in the treatment of any disease, it is first necessary to understand their physical properties and physiologic effects. The ultraviolet rays, invisible rays at the far end of the spectrum, penetrate to a depth of about

one-thirty-second inch. They cause chemical changes in the tissues by increasing the calcium and phosphorus content of the blood, and the deposit of melanin or pigment matter in the skin. The very short ultraviolet rays are germicidal in action. The longer rays are indicated in diseases of the mouth due to calcium or phosphorus deficiency, infections, anemia and tuberculous lesions.

The infrared rays, which are also invisible, are at the near end of the spectrum. They are much longer than the ultraviolet rays, penetrating soft tissues to a depth of nearly 7 inches. These rays heat the deep tissues, but cause no chemical change. They are employed, therefore, to promote resorption of inflammatory exudates by the production of superficial or deep hyperemia.

The short ultraviolet rays, the wave length of which is about 2,537 Angström units, are applied directly to the lesion by means of a quartz applicator, which becomes quite warm, but not hot. A special apparatus is required to generate them. One must bear in mind that since these rays are easily absorbed, the secretions and scabs on the lesions must be entirely removed in order to obtain the desired effect.

We have found these rays of benefit in pyorrhea, aphthous stomatitis, pemphigus, simple infections and, especially, in leukoplakia and tuberculous ulcers. In leukoplakia, a mild desiccating current is used in association with the ultraviolet radiation. If the lesions are local manifestations of a constitutional disease, we consider it necessary to irradiate the entire body with the longer ultraviolet rays, those between 2,900 and 3,100 Angström units. These are generated by the air-cooled mercury quartz machine. We usually start with one erythema dose over four areas of the body. The erythema dose varies with each machine.

The infrared rays, which are generated by an element composed of carbon and iron, are indicated in parotitis and cervical adenitis. We have found them to be very beneficial in tuberculous adenitis. At the Philadelphia General Hospital, a number of white and of colored patients suffering with chronic tuberculous adenitis and draining sinuses were treated by infrared radiation in conjunction with the long ultraviolet rays. The results have been most gratifying, with several complete cures.

The short ultraviolet rays are an important adjuvant in pyorrhea and gingivitis. After all the débris is removed and the gums are thoroughly dried, large erythema doses, daily or on alternate days, often prove effective in combating the infection.

We have treated facial palsy for many years with a combined sinusoidal current and the results have been uniformly good. A combined sinusoidal current is a combination of the faradic and galvanic currents which have been modified by a specially constructed coil, the current increasing gradually from zero to the desired strength and then diminishing gradually to zero. Now the polarity is automatically changed and the current again increases from zero to maximum intensity, then decreases to zero.

It has been our practice to deliver from six to eight cycles per minute.

The sinusoidal current has the following advantages over the ordinary galvanic and faradic currents: It does not shock the nerve because it flows in gradually and is not painful. The nerve does not become fatigued because there is a slight rest period on the cycle and between the cycles of contraction. The regular changes of polarity prevent a polarizing effect on the tissues. There is no danger of overstimulation.

This treatment is instituted about a week after the onset of the paralysis, and the strength of the current is regulated to produce only mild contractions.

Occasionally, we encounter patients with permanent disfigurement due to neglect or improper treatment.

The following case histories illustrate the results which can be obtained by physical therapy.

CASE REPORTS

CASE 1.—M. S., aged 66, referred by a dentist, presented an epithelioma of the lower gum, the diagnosis being confirmed by biopsy. The growth was destroyed by a thermocoagulating current. The root of a tooth was found embedded in the tissues. The patient stated that the tooth had been extracted thirty years previously and the extractor had said no harm would result from allowing the root to remain in the gum. There was no recurrence of the lesion after four years.

CASE 2.—H. C., aged 32, presented an epulis of the middle of the upper gum. Examination of the jaw revealed a soft bleeding tumor on both sides of the gum between the teeth. Both teeth were black from silver nitrate. The condition had been present four months. The dentist had excised the growth three times, but it promptly recurred each time. Later, the patient's physician attempted to destroy it with silver nitrate, of course without success. We anesthetized the area around the tumor with a 10 per cent solution and the growth was thermocoagulated. At the end of five weeks, the wound was completely healed. Seven months have now elapsed with no recurrence.

CASE 3.—F. H., a man, aged 49, an excessive smoker, had on the left side of the lower lip a bleeding ulcerated growth about the size of a bean, which had been growing for about five months. It was destroyed by thermocoagulation, and when the slough dropped off, a deep hole remained in the lip. The wound was completely healed in six weeks, with no contraction of the lip.

CASE 4.—B. W., a man, aged 59, had leukoplakia involving the roof of the mouth and the rim of the upper gum. The leukoplakia was treated with a mild desiccating current, and then irradiated with short wave ultraviolet rays. Only one desiccating treatment was given, but the ultraviolet irradiations were continued twice weekly for six weeks, when the lesions disappeared completely.

CONCLUSIONS

1. Physical therapy, either *per se* or as an adjuvant, plays an important rôle in the treatment of oral disease.

2. Malignant growths must be completely destroyed in a single operation, as this is the best insurance against metastasis and recurrence. It is also essential to destroy an area of normal tissue surrounding the lesion, in order to establish a protective wall against the spread of neoplastic cells.

3. Electrosurgery with the "short wave" cutting current is a dangerous procedure. Severe hemorrhage is frequently a complication and it is difficult to determine with any degree of accuracy the thickness of tissue which it will destroy.

4. Ultraviolet and infra-red rays are valuable agents in treating oral diseases. Their importance has been enhanced by advanced knowledge of their physiologic and physical properties and by the use of improved generators.

1823 Pine Street.

CORRELATED ANALYSIS OF THE DENTAL CARIES PROBLEM

By Charles B. Branson, D.D.S., Lincoln, Nebr.

More than a half century ago, Miller announced his chemico-bacterial theory of dental caries, a theory which has been generally accepted as explaining one phase of the problem, but which has failed to reveal why rampant caries may occur in the mouth of one individual, while another remains immune, under apparently the same general conditions.

Accordingly, it has become most evident that we must now turn to conditions other than bacterial for the primary cause of dental caries, perhaps to factors already known, but the importance of which has not yet been recognized or clearly understood.

From the tangled maze of dental caries data now available, four outstanding considerations besides the bacterial now present themselves for our future direction and guidance, considerations which tend to narrow further research to a very definite field, as indicated by the following:

1. Neither immunity nor susceptibility to caries can now be regarded as "fixed" states *per se*, but are subject to fluctuations and even to radical reversals under certain conditions—dietary changes particularly—with but little regard for tooth structure, apparent general health, heredity or environment, as so conclusively proved by Price in his research among the primitive races over virtually the entire world.[1]

2. Caries itself is neither natural nor normal in any sense, but is an "acquired" disease, closely related to food imbalance—a disease which has plagued mankind whenever and wherever he has sought to replace, to any considerable extent, the unrefined "natural" foods with the refined foods, the carbohydrates especially.

3. The refined cereal starches and refined sugars are apparently the basic undermining "offensive" factors in dental caries, but their relationships have as yet been only partially understood or disclosed.

4. The saliva itself is Nature's fundamental means of defense, its protective influence having also been but partially revealed up to now.

With these basic considerations before us, the dental caries problem virtually resolves itself into one of obtaining a more comprehensive understanding of the latter two: a. Why refined starches and sugar tend to contribute so largely to the development of dental caries, while the unrefined carbohydrates in general exert no such influence and may even be "protective." b. How the saliva normally manages to effectively protect the teeth of the "immune" against caries, yet fails to exert such protection in the caries-susceptible. c. What aid the general system renders the saliva in the performance of its protective function. d. What disturbance or perversion of either the saliva or the general system, or both, may result from the use of refined carbohydrates, that caries is thus "permitted" to occur to a universal extent. e. What particularly favorable condition "attracts" the lactobacillus to the mouth of the susceptible, while the mouth of the immune is virtually shunned.

When these fundamental questions are

clearly understood and are definitely answered, the so-called "secret" of both dental caries and immunity should readily unfold before us in a comprehensive and logical manner.

It is the purpose of this analysis to now present certain physiologic data relating to these basic questions, data which may clarify in a simple and definite manner much of the seeming "mystery" that now appears to surround the underlying cause of dental caries.

IMMUNITY VS. SUSCEPTIBILITY

Dental caries reséarchers have long recognized that the mucinous dental plaque is the "laboratory" in which the lactic acid is formed which, in turn, dissolves the enamel sheath as the initial step in dental caries. The fundamental question now arises: What basic provision does Nature normally make for the prevention or even removal of such a plaque, so as to avoid the occurrence of caries by eliminating the conditions which precede its development?

When the immunity aspect of the problem is thus approached from a strictly natural or biologic point of view, the very "key" to its unfoldment is found to apparently lie in one fundamental physiologic factor—the inherent power of the salivary enzymes, under normal conditions, to dissolve, digest and thereby virtually destroy the carbohydrate débris which tends to provide both nutrition and a "nesting" place for the destructive lactobacillus. This, in cooperation with the acid-neutralizing salts of the saliva, has obviously been Nature's plan for safeguarding the teeth of the primitive immune throughout the ages, and even now protects the small minority of the immune.

In the susceptible, however, when the dental plaque is somehow "permitted" to develop and dental caries to thereafter ensue, it appears equally obvious that some abnormal disturbance of the salivary function has occurred to weaken its digestive powers; or else some abnormal state of resistance on the part of the carbohydrate débris has resulted from the refinement and combinations involved, thereby rendering the débris impenetrable to the saliva, its alkaline salts and its digestive enzymes. Both of these adverse basic factors appear to exist concurrently, as will be hereafter described in more detail.

The following outline covers the more fundamental facts and relationships to be considered, in some detail, relative to both immunity and susceptibility:

1. Saliva: general nature, protective agencies and functions.
2. Unrefined carbohydrates vs. refined: respective relationships to immunity and susceptibility to caries.
3. Tendency of concentrated, refined sugar combinations to seriously disturb the salivary digestive function—an underlying cause of dental caries.
4. Tendency of refined sugars and starches to create a favorable medium for lactobacillus development, thereby virtually "inviting" its presence.
5. Rôle of the general system as a factor in immunity and caries.

SALIVA: PROTECTIVE AGENCIES AND FUNCTIONS

The saliva is known to be fundamentally an electrolytic solution, consisting of about 99.4 per cent water, in which are suspended various ionized alkaline salts, digestive enzymes, mucin and various other elements.[2] It is thin, only slightly viscous and highly penetrative under normal conditions.

In function, the saliva assumes a dual rôle: It initiates digestion of the starchy foods, and it serves as a fundamental protector of the teeth and the membranes of the mouth. In their digestive function, the salivary enzymes—the ptyalin and maltase—not only prepare the starches for final digestion in the alimentary canal, but also are capable of completing the digestion of such starch

entirely within the mouth, their action rendering cooked starch soluble and reducing it through dextrin into maltose and then into glucose. However, as far as is known, according to Sherman, the saliva contains no enzymes capable of hydrolyzing or reducing refined sugar.[3] The basic significance of the latter in connection with dental caries will be later mentioned.

As their protector, normal saliva cleanses the teeth of adhering starchy débris through the digestive action of the ptyalin, Nature's prophylactic provision. The saliva also tends to neutralize all mouth acids wherever it may penetrate, through the action of the alkaline salts which it contains. It also serves as a general solvent and mouth flux, as is well known. Further, under physiologic conditions, the saliva appears capable of remineralizing disintegrated enamel and carious dentin, presumably through electrochemical deposition of the mineral salts held in ionized solution.

Thus, under normal conditions, Nature has provided a protective mechanism for effectively safeguarding the teeth, a protection which has proved highly efficient throughout the ages for man when he is subsisting upon the natural diets which environment makes available for his use. But whenever refined carbohydrates are introduced into his diet, sugar in particular, dental caries, it is well known, tends to become the rule rather than the exception, as has been the case in primitive man up to quite recently.

What dietetic "crime" are we unwittingly committing in the use of refined carbohydrate foods, Nature now apparently refusing to afford adequate protection against the onslaught of dental caries? Why is the salivary ptyalin now unable to exert its digestive powers and functions against the refined starchy débris and dental plaque, which both feed and protect the lactobacillus, on the activities of which the initial disintegration of enamel appears to depend? Why cannot the saliva, with its acid-neutralizing salts, now penetrate the dental plaque, as well as reach every "nook" and "cranny" of the mouth as it normally should do and as it evidently does in the mouths of the immune and in those with "arrested" caries?

A definite and logical answer to these fundamental questions may be readily found through a simple comparison of the physical, chemical and biologic protective principles of the unrefined foods, in contrast with those of the refined carbohydrates, a comparison which clearly reveals the causes underlying both immunity and susceptibility to dental caries.

UNREFINED CARBOHYDRATES

In all of the unrefined carbohydrates which we consume, fruits, vegetables, whole grain cereals, etc., Nature has blended the sugars and starches in a colloidal relationship with certain gelatins, gums, oils, mineral salts, vitamins, enzymes and other elements for creating a protective balance, one which contemplates cooperation with all digestive agencies, including the teeth and oral secretions.

Physically, this relationship provides a cellular porosity or network, as in a spongy, humus-containing soil, thereby permitting effective penetration by the saliva, as well as preventing adhesive débris from sticking to the teeth. Through this permeation by the saliva and its digestive enzymes and mineral salts, digestion of the starchy elements in the mouth débris is readily achieved and fermentation prevented, the natural and normal plan of protection and prophylaxis which Nature automatically provides when unrefined carbohydrate foods are consumed.

Chemically considered, the alkaline salts in the unrefined carbohydrates are so blended with the fermentable sugar and starch elements that an acid-base equilibrium tends to automatically pre-

vail as a further safeguard against oral débris fermentation, plaque formation and the occurrence of dental caries. Then, as an additional precaution, for facilitating digestion of starchy elements, Nature appears to have embodied various digestive enzymes in unrefined carbohydrate foods, to aid in their own digestion, as indicated by the self-reduction of starches into sugars in the ripening of fruits, and also by the diastase contained in the cereal grains.

From a biologic standpoint, Nature has imposed a special "restrictor" upon sugars and starches in their unrefined state, a restrictor in the form of a colloidal blending with the various other elements named above, to prevent undue concentration of such sugars and starches as might overstimulate the nervous system, excite the digestive fluids to too great activity or otherwise interfere with the orderly process of digestion, as refined sugar combinations are known to do.

REFINED SUGARS AND STARCHES

In the process of refinement, sugar is stripped of all its mineral salts and its vitamins, colloids and various other "protective" elements needed by the body for building systemic reserves, on which the quality of the saliva, as well as all other fluids of the body, must necessarily depend.

Refined sugar thus contributes nothing to the general system but "calories," while largely displacing other protective foods in the diet. Such sugar, known also as sucrose or cane sugar, is one of the chemical crystalloids, capable of direct absorption into the system, under certain conditions, without undergoing the process of normal digestion. It is extremely soluble, highly stimulating to the nervous system and very fermentable. When ingested in liberal quantities or in concentrated form—candies, confections, etc.—it tends to irritate the mucous membranes of both mouth and stomach, stimulating their secretions to an increased flow of mucus.[2] Furthermore, such concentrated sweets inhibit the action of the salivary ptyalin in digesting starchy foods and render the saliva acid in reaction almost immediately.[4]

Overstimulation of the mucous secretions thus tends to increase the viscosity of the saliva to the "ropy" state, thereby reducing its penetrative power, as well as the protective action of its alkaline salts. In this manner, the saliva is perverted from its normal function of starch digestion and acid-neutralizing efficiency through a copious flow of saliva, to a defensive agent against the reactions of concentrated sweets, involving a scanty viscid flow.

The fundamental purpose of the saliva is to split up and digest the starches, but not cane sugar, virtually a predigested starch and so requiring no salivary digestion. As already mentioned, no enzyme contained in the saliva is known to be capable of hydrolyzing refined sugar.[3] However, such sugar has the ability to retard, or even stop, the digestion of starch and its débris within the mouth by inhibiting the ptyalin action. This fact largely explains the rôle of sugar in the dental caries problem, interfering with starch-débris digestion and inviting fermentation.

If starch-débris digestion within the mouth reaches but the first stage, dextrin is formed, one of the most favorable media known for development of the lactobacillus.[5] Thus, through inhibition of ptyalin activity from any cause, starch digestion in the mouth is rendered incomplete, perhaps not going beyond the dextrin stage. When starch débris, dextrin and mucin are thus permitted to combine, surcharged with sugar which the salivary enzymes cannot hydrolyze, an ideal environment is provided for creating an impenetrable mucinous plaque, for the propagation of the lactobacillus, and for the development of dental caries. The lactobacillus is not present in

the mouth in great profusion by accident, but because of a superabundance of food peculiar to its needs, and, by fermentation processes, it seeks to reduce that which the salivary digestive enzymes fail to reduce by normal digestive means.

REFINED STARCHES

Refined starch *per se* tends to be a salivary depressant in that it lacks any definite natural flavor such as the unrefined starchy foods possess, to stimulate the saliva to increased flow and to "activate" its digestive enzymes. Because of this lack of flavor, refined starch, in the usual form of white flour combinations, is made a "vehicle" for carrying various unnatural foreign flavors and combinations of an entirely unrelated nature, flavors and sugar combinations which have no inherent power to stimulate the starch-digesting salivary enzymes, thereby tending to leave a mass of unreduced starchy débris adhering to the teeth, impenetrable to the alkaline salts of the saliva when the salivary digestive action is incomplete.

Both refined sugar and starches tend largely to displace the various unrefined mineral and vitamin-containing carbohydrate foods in the modern diet, owing to (a) the more "stimulating" nature of the former in their many attractive forms; (b) a tendency to satisfy the desire for "calories" despite their deficiencies, and (c) their availability and cheapness.

While both these refined carbohydrates are caloric foods, they become competitive to a large extent from a digestive standpoint, often with the result that the sugar virtually displaces the starches when eaten at the same meal in excess of body requirements for calories. When thus ingested in larger amounts than needed, the starches, it is evident, requiring several stages for digestion, cannot successfully compete with the more stimulating, quickly absorbed sugar, which takes precedence by even inhibiting starch digestion. It is, therefore, the starches which appear to contribute most directly to the development of caries, although the sugar seems to be the actual "instigator."

In the light of the evidence here presented, it becomes quite clear why the unrefined carbohydrates are "protective" in the broader sense and tend to afford natural immunity; while the refined types appear to contribute directly to susceptibility to dental caries, together with various other systemic disturbances less readily recognized.

DENTAL HEALTH VS. GENERAL HEALTH

Through long-continued habit, civilized man has developed a tolerance for the refined carbohydrate foods, in quantities and in combinations which the primitive could scarcely withstand, regardless of his normal health and vitality. Accordingly, it is worthy of note that the various primitive races everywhere tend to rapidly develop the degenerative physical diseases along with dental caries, whenever they seek to adopt our "modern" refined foods. Tuberculosis, especially, is known to be rapidly destroying these races today, yet there will be no end of the decline in sight until they, as well as we, learn how to more effectively combine and more temperately use these subtle refined carbohydrate foods, particularly sugar combinations. In every case, the teeth appear to be first affected by these dietetic changes to the refined foods, with the physical decline following thereafter apparent even in the first generation.

No fundamental diet can be considered truly "balanced" which does not promote sound dental health as well as general health, which must be considered as a unit. Nor can any diet be termed "adequate" which contains a large proportion of refined carbohydrates for the sake of mere calories, since such foods tend not only to displace the vital "protective" foods in the diet, but also to

disturb all the digestive secretions and functions along the entire alimentary canal, with particular emphasis upon the salivary functions.

For several years, various leading nutrition scientists have been advocating the simple, unrefined natural foods once again for the sake of general health; foods with their mineral and vitamin elements intact, simply prepared and in simple combinations; an abundance of fruits and vegetables, both cooked and raw; all dairy products; meat in moderation; cereals, largely unrefined, with only a minimum of the refined carbohydrates—starches and sugars. Through such a dietetic régime, balanced according to Nature's general plan, we may materially aid in educating the general public, through our patients, toward the attainment of dental immunity.

CONCLUSIONS

The fundamental natural protector of the teeth against the occurrence of dental caries is a normal saliva, in chemicophysiologic equilibrium. Such saliva has the inherent power, through its digestive enzymes and alkaline salts, to cleanse the teeth of all fermentable starchy débris, break up mucinous dental plaques and neutralize any acids therein existing.

Dental caries appears to be due, fundamentally, to a derangement of the salivary function, a derangement in which the saliva becomes unable to perform its normal purpose of dissolving, digesting and removing all starchy débris remaining upon the teeth and neutralizing oral acids, thereby virtually "permitting" the development of the dental plaque, acid formation and consequent enamel disintegration.

This functional disturbance may be traced largely to an overingestion of refined carbohydrates, particularly to concentrated sugar combinations. Such sugar tends to stimulate the saliva to an increased mucus flow which is heavy and viscid. It inhibits the action of the salivary digestive enzymes which digest starches, and prevents effective penetration of the alkaline salts, thus seriously interfering with normal salivary functioning, contributing to fermentative processes and thus inviting caries.

The relative immunity or susceptibility of the individual to dental caries appears to depend on (a) the systemic reserves for salivary requirements; (b) the general health and vitality; (c) the systemic tolerance for the refined carbohydrates in concentrated form, and the ability to assimilate them; (d) the degree of concentration and the amounts consumed; (e) the proportions of refined starches and sugary foods ingested, and (f) the frequency of use.

Nature has definitely prescribed unrefined carbohydrates for the protection of both dental health and general health. When we abandon or ignore such protective principles by "denaturing" our foods, Nature seems to abandon us, withdrawing her protection, particularly in regard to the teeth, which have no direct defense against acids.

When we rightly interpret the fundamental laws of nutrition, and conform to them, we may again reclaim our dental "birthright"—freedom from the scourge of dental caries.

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609 Federal Securities Building.

THE JOURNAL *of the* AMERICAN DENTAL ASSOCIATION

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APRIL *Editorial Department* 1941

MOUTH HEALTH AND MILITARY SERVICE

THE masticating efficiency of the new recruit being inducted into the military service of the nation has always been a fundamental health consideration in any and all preparatory activities of the military arm of the government. Recognition of the desirability of and even necessity for a healthy digestive apparatus as a prerequisite for military service is attributed even to Napoleon, as expressed in his philosophic observations on large scale military operations, in the well-known aphorism that "an army travels on its stomach."

This government, as far back as the war between the states, recognized, even though vaguely, the desirability of a good masticating apparatus as a health asset to the soldier.

At the time of the Civil War, the military authorities established a standard of dental qualifications which demanded as a prerequisite for admission to army service that the new recruit should have a sufficient number of teeth to enable him to masticate his food and, more particularly, to enable him to bite off the paper cap of the cartridge which constituted the then prevailing type of ammunition.

With the introduction of improved arms and ammunition, the paper cartridge became obsolete, but, strangely enough, according to army

experts, infantrymen today "fight with their teeth." The American army is proud of its skill and prowess with hand grenades, and combat infantrymen must have good incisor teeth in both jaws, as the common practice is to tear out the cap or pin of the hand grenade with the teeth before hurling it at the enemy.

The government standard of dental efficiency—teeth sufficient and suitable for purposes of mastication—still obtained, and was later expanded to a broader conception of dental efficiency as manifested in the present requirements; namely, that the mouths of recruits shall be free from suppurative conditions and that there shall be three pairs of anterior teeth in contact and three pairs of posterior teeth in contact. Although the standard for masticating efficiency here implied is an arbitrary one and subject to a wide range of individual interpretation, we may assume that recognition of the important relation which mouth health bears to the health of the soldier is to some degree taken into account. The value and sphere of usefulness of the dental surgeon are becoming increasingly evident as the importance of mouth health becomes more generally recognized in military and administrative circles.

As far back as 1901, dentistry was established as a factor of military service through an act of Congress that provided for dental service in the Army and Navy, and even though the service at that time established was barely above menial work, it was eagerly accepted by the dental profession as a means and opportunity to demonstrate the value and indispensable character of the service which dentistry was capable of rendering to those in the fighting forces of the nation.

Later, the dental surgeon was accorded a rank and dignity more in accord with his professional standing, and the evolution of dentistry since its first humble recognition by the government has completely reorganized, recreated as it were, dental ideals and reoriented the point of view and estimate of the dental field of activity, both within and without the dental profession.

That dentistry, notwithstanding the gradual elevation of its standards and status in the army service, has not yet come fully into its own, either in government recognition or in the public estimation, is painfully and impressively demonstrated by practically the first statistical studies of the results of the physical examinations of those who have been called to service before the compulsory selective service boards of New York City. The total number of registrants examined by the New York draft boards was 17,540. Of these 13,422 were accepted for general military service. Of those who qualified for full or limited service, 9,925 were

acceptable for full service and 3,497 were available for limited duty only.

The leading cause for rejection was tooth and mouth conditions—1,418 men or one-fourth of the total number rejected were rejected mainly because of insufficient teeth. The statistics from the New York City Board are practically duplicated in every district from which figures are available. From Chicago, 25 per cent of the rejections in 6,000 examined were due to dental conditions; Iowa, 26.66 per cent; California, 25 per cent; Georgia, 30 per cent; Nebraska, 22 per cent; Utah, 40 per cent, and Texas, 25 per cent.

These figures, representing samples from the various sections of the country, are indicative of the distressing condition of the teeth and mouths of the young men of the country within the draft age. If only from an economic point of view, these figures should be sufficiently impressive to convince the governmental authorities that the entire man power of dentistry should be utilized only for rendering mouth health service to the draftees before as well as after entrance into military service.

For the moment, we are confronted with the dramatic revelation that one-fourth of our young men are not physically fit for the defense of our country solely because they are unable to meet the minimum dental recruiting regulation. It is a dramatic revelation because so directly related to conditions and circumstances just now occupying the center of the attention of the whole world, a situation not only dramatic in itself, but which may easily become tragic in its consequences to us as individuals and to the nation at large.

Many of the mouths of the draftees could readily be placed in a condition to make them acceptable to the boards, as was the case in the World War, at which time the Preparedness League of America, under the enthusiastic and capable direction of J. Wright Beach, of Buffalo, did yoeman service in this respect. It must be borne in mind that the large majority of these examinations have been made by medical men; in fact, in but a few districts were dentists connected with draft boards. That mistake has now been rectified, and each board will have a dentist connected with it in the future, so that we may expect a larger percentage of applicants to be rejected on account of mouth conditions.

We contemplate with much anxiety the probable condition of the mouths of the accepted men after they have been in the service for any length of time, in view of the lack of appreciation of mouth health apparent in medical military service.

As dismal as are the prospects for adequate mouth health in the Army, they are even more unpromising for the public if the present program of the Conscription Act is pursued to the letter in drafting members of the dental profession for line service.

What a shortsighted fallacious policy!

According to the original plan of the Army Dental Corps, as many of the draftees as possible were to be given officers' rank, and it was thought that all available members of the dental profession would be needed to provide for necessary dental service. Now, however, it develops that the Dental Corps has been definitely limited, and dentists are being drafted into line service in the army.

Thus, the dental profession finds itself in the anomalous position of being responsible for the dental health of the Army and the public and, at the same time, being compelled to augment the actual fighting forces of the Army. There are not sufficient numbers in the dental profession to warrant such a double rôle.

The mistake of the last war, when hundreds of recent dental graduates were caught in the draft and served throughout the war as enlisted men, should be avoided.

In an effort to avoid such a disastrous error as here threatens, the Committee on Dental Preparedness of the American Dental Association has thoroughly canvassed the possibilities of relief through the Army Medical Corps and it has become evident to the Committee that our only hope of averting what we believe to be a professional calamity is through legislative action. Senator Murray of Montana has volunteered his efforts toward relief from this serious threat to the dental profession and has presented before the Senate Senate Bill 783, which will afford the desired relief through legislative channels. The Preparedness Committee is unanimous in its support of the Bill and urges that every member of the profession in or out of the draft age do everything in his power to promote passage of the proposed legislation. The attitude of the Committee is reflected in a statement to be found on page 634 of the present issue.

Speed is the keynote of the emergency and we appeal to the professional instincts of every dentist to act now by contacting his Senate and Congress representatives, and in any other manner that offers hope of favorable results.

The present emergency, if the efforts of the dental profession are properly directed, will furnish an opportunity for greatly enhancing the position of dentistry in the Army. It is inevitable that there will soon be

an urgent demand for a greatly enlarged enrolment of dental surgeons in the Army and Navy; and it is important that those who have the best interests of the profession at heart see to it that only men properly equipped, men who have the best training and who have correct ideals as to the meaning of our profession, shall be admitted to the government service. They must become propagandists of the idea that dentistry is a specialized department of the healing art, and not a sublimated form of artisanship.

BIBLIOGRAPHICAL

The American Textbook of Operative Dentistry. Edited by Marcus L. Ward, D.D.Sc., Seventh Edition, September 1940. Octavo; 925 pages. 587 engravings. Cloth $11. Philadelphia: Lea and Febiger.

THE seventh edition of the American Textbook of Operative Dentistry is another text of encyclopedic character. It is essentially a new book, although it follows the general plan of the earlier editions The outline of contents reveals the fact that the editor uses the term operative dentistry in a broad sense. The chapter headings, with authors, are as follows:

I. Examination and Diagnosis in Dental Practice. By Kurt H. Thoma, D.M.D.

II. Oral Hygiene. By Russell W. Bunting, D.D.Sc.

III. Operative Procedure, Except Restorations with Inlays and Parodontal and Root-Canal Therapy. By Arthur B. Gabel, M.A., D.D.S.

IV. Metal Inlays. By William H. Crawford, D.D.S.

V. Porcelain Inlays. By William D. Vehee, D.D.S.

VI. Filling Materials. By Marcus L. Ward, D.D.Sc., and Floyd A. Peyton, Sc.D.

VII. The Treatment and Filling of Root Canals. By Edgar A. Coolidge, D.D.S.

VIII. Treatment of Hypersensitive Dentin. By Thomas J. Hill, D.D.S.

IX. Discolored Teeth and Their Treatment. By Thomas J. Hill, D.D.S.

X. Local Anesthesia. By Louis I. Grossman, D.D.S., D.M.D.

XI. The Treatment of Parodontal Diseases. By Russell W. Bunting, D.D.Sc.

XII. Focal Infection. By Arthur C. Curtis, B.S., M.D.

XIII. Extraction of Teeth and Other Surgical Procedures. By John W. Kemper, M.D., D.D.S.

XIV. Fundamental Principles of Orthodontics Which Should Be Understood by the General Practitioner of Dentistry. By Arthur L. Morse, D.M.D.

The list of contributors is well chosen, each man being an authority in his field. The text is well written, modern and comprehensive. The inclusion of chapters on related subjects enhances the reference value to the general practitioner. Each section contains a bibliography and there is a compact index.

In view of the fact that dentistry has developed so extensively in recent years, one might question the wisdom of including such a wide variety of subjects under the heading "Operative Dentistry." This arrangement tends to limit the space available for the description and illustration of the subject matter pertaining strictly to operative dentistry. At the same time, it does not allow enough room for adequate treatment of such subjects as oral hygiene, local anesthesia, periodontal disease, focal infection and extraction of teeth. This is illustrated by the fact that several of the contributors have written complete texts concerning their respective subjects. The traditional arrangement results in an extremely large volume essentially an abbreviation of several, more

detailed texts. Those readers interested primarily in operative dentistry will be disappointed to find the chapters written by Gabel, Crawford, Ward and Hill limited to 345 pages. Several operative methods of major interest to the practitioner are not discussed. These objections are of little consequence to the reader who is interested in an abridgement of modern dentistry. Many dentists find this kind of book very handy for frequent reference because it does contain such a miscellany of authoritative information. One must guard against the tendency to assume that a text of this type contains alf the worth while information available. The frequent use of bibliographic references and an excellent expression of the scientific viewpoint by the authors of this text minimize this danger.

The attitude, expressed in the editor's statement in the preface, that "in general the arrangement is the same as it was in the sixth edition, but the contents are of a more scientific character, better related to medicine, public health, and therapeutics, and coordinated with respect to prevention," is one of the great contributions of the book. Some readers of this review may feel that the criticisms expressed indicate a dissatisfaction with the book on the part of the reviewer. This is not true: they should be interpreted as a request for more information in regard to the technical aspects of operative dentistry, presented in this manner. In other words, the chapters written by Gabel on "Operative Procedure," by Crawford on "Metal Inlays," by Ward on "Filling Materials" and by Hill on "Treatment of Hypersensitive Dentin and Discolored Teeth" leave the reader hungry for a more detailed discussion. The content and manner of presentation of these chapters are truly representative of the best in operative dentistry. The editor is to be congratulated upon the presentation of a text that reflects the modern viewpoint. The reviewer recommends it highly to the reader interested in this subject.

Textbook of Dental Anatomy and Physiology

By Russell C. Wheeler, D.D.S., F.A.C.D., Associate Professor of Dental Anatomy, Human and Comparative, St. Louis University School of Dentistry, Chairman of the Department. 415 pages. 394 illustrations. Cloth. Price $6.50. Philadelphia: W. B. Saunders Company.

THIS volume represents one of the newer trends in what is probably the oldest fundamental dental subject. Anatomists in general are now inclined to correlate form and function rather than continue the old orthodox philosophy wherein form was assumed to be the most vital portion of the anatomist's work. Wheeler stresses this point early in his preface and draws attention to this relationship in the title.

Descriptions of the teeth and methods of reproducing them by carvings are presented in the customary manner. The profusion of illustrations adds considerably to the value of the morphologic descriptions. Preceding the description of a given tooth is a short table giving the time of the first evidence of calcification of the tooth, when the enamel is completely formed, the date of eruption and the time of completion of the root. To the student, such a view of the structures upon which he is working, presented while he is working, is of definite value.

Wheeler's tables of "average" dimensions of teeth are complete and no doubt statistically accurate. Carving to such measurements, however, finally results in a tooth with all of the desired characteristics, but with no tooth "personality." It appears that tooth measurements must be made on the same tooth if it is not to have an artificial appearance.

The drawings and photographs are all excellently executed, as is also the glossary.

While this book presents a definite effort in the discussion of function, it remains for another edition to carry this discussion still farther along the same path. An attempt might also be made to mention more frequently the phylogenetic background of the structures discussed. While it is not necessary that the book have a chapter on comparative anatomy, constant references to its subject matter are important to a better understanding of tooth form and function.

In general, Wheeler's text is outstanding in its field and should receive an enthusiastic reception from those interested in this subject.

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President's Page

To the Members of the American Dental Association, Greetings!

In the February issue of THE JOURNAL, the program of the Annual Officers' Conference was outlined and we rather boasted that this year's program was to be different, the result of a letter survey, and that it was requested by the officers of the constituent state associations. We tried faithfully to carry out these state officers' suggestions.

Now the question is, was the program worth while? And if not, why? If it was a step in the right direction, how can it be further improved?

In the past, the constituent officers, in their replies, complained that enough pertinent information regarding the affairs of the American Dental Association was not made available to them. This objection, we feel, was definitely overcome in the morning's arrangement. The afternoon section of the program, quite frankly, was not so well arranged as it should have been. The papers presented were of the finest and the information imparted was of great importance to the officers of the state dental associations, but neither the writers nor the information given received the consideration each was entitled to. Next year, this part of the program must be improved.

I wish that those of you who were present at the Conference would write your impressions of the meeting, telling frankly what portion of the program could be made more effective and how it should be done. This information will be given serious consideration by Oren A. Oliver, President Elect, who will preside at the Conference next February.

THE NEW PUBLICATION, "ASSOCIATION"

The booklet "Association," of sixty-four pages, is chock full of information for the dentist regarding the activities of the American Dental Association. It starts by saying "This is a success story." It gives an interesting, brief history of the beginning of dentistry in America and then takes up every office, department and committee in the American Dental Association, telling what is being done and why it is being done. It tells us where the Association money comes from and where the money goes and why. It tells the costs of maintaining the various departments and committees and what benefits are derived therefrom. All in all, it is the explanation of the activities, the income and the expenditure of our monies that the members have been asking about for several years. It is a readable, most

interesting, authentic history of the activities and benefits of the American Dental Association.

This booklet is available to the members at no cost whatever. All a member has to do is to write a card to the Central Office requesting the booklet "Association" or to request the secretary of his component society to write the American Dental Association, Bureau of Public Relations, 212 East Superior St., Chicago, stating the number of members in his society and requesting that he be sent the required number of books. These books will be sent immediately. After reading what our organization is doing and how it is being done, I am sure you will be more proud than ever that you are a member of the American Dental Association.

MEMBERSHIP

Remember the goal this year is 55,000 members by October 31. For your convenience, and that the members of the American Dental Association may be kept informed as to just what their state associations are doing, a "Membership Percentage Chart" is to be found monthly in THE JOURNAL, under "Association Activities." In the March issue, the chart was on page 472.

On page 664 of this issue will be found an up-to-the-minute membership record of each state. This chart will tell you exactly how each state is progressing, and if your state is not advancing in membership as you think it should, it is your duty to stimulate your officers and the membership committees to greater activity. The booklet "Association" is available without cost to all local membership committees. It is to be used as a silent salesman to tell the story of the American Dental Association. We hope that the membership committees will make use of this book in their solicitation of the new member. It really tells the story.

QUESTIONS AND ANSWERS

A new department under "Questions and Answers" is to become a regular feature of THE JOURNAL in the near future. Those problems every dentist is confronted with from time to time in his practice may be sent to the Editor, who will refer them to a specialist for diagnosis. This is a service long needed by the members of the American Dental Association.

INSURANCE

This month, the Committee on Insurance will release a report that will be of special interest to those of our members who are not insured under the American Dental Association plan.

The Committee on Insurance is serving thousands of American Dental Association members. Since the inception of the insurance plan, about ten years ago, our insurance company has distributed

to beneficiaries in excess of two and one quarter millions of dollars. Almost without exception, these beneficiaries have voluntarily written to express their deep appreciation of the lack of red tape and the speed with which the money has been made available to them in their hour of need.

This insurance is sponsored by the American Dental Association as an added benefit of membership. By the use of the American Dental Association Insurance Plan, a substantial savings is made for policy holders. Evidence of the membership's appreciation of this service is readily apparent from the fact that more than 4,200 have applied for the coverage within the past two and one half years.

If you are eligible (age 50 or less), it is to your advantage to investigate.

HOUSTON—THE CITY BEAUTIFUL

I cannot close this letter without a word in praise of the City of Houston, the enthusiasm for the Annual Meeting existing among the dentists who are to be hosts to the members of the American Dental Association during October and the unusually fine facilities for taking care of the meeting as well as assuring the comfort of the visiting dentists.

I arrived in Houston on February 11 with the thought of seeing what the city was like and finding out, if possible, how far the Local Arrangements Committee had progressed.

I had heard many reports about Houston, the city, but I did not know exactly what to expect. Imagine my surprise on arriving and being shown the sights by the general chairman of the Local Arrangements Committee, Walter H. Scherer, to find an unusually prosperous, modern and beautiful city. The streets were wide and well paved, the buildings large, modern and well cared for, the stores filled with merchandise of the latest and best qualities artistically displayed. It is a city of which any citizen may well be proud to say "I live in Houston."

And hospitality! It is enough to say that the dentists of Houston are Texans.

The physical requirements are more than adequate. The official headquarters, The Rice, is a beautiful hotel with one thousand rooms. Other hotels in the city have more than sufficient accommodations to care for the visiting dental members and their needs.

The Auditorium has floor space and section rooms enough to accommodate a convention twice the size of the Annual Meeting of the American Dental Association.

The plans for the clinics and the scientific program are most extensive. One feature of this part of the convention is to be Pan American Dental Day. The dentists of the Spanish American countries are to be invited to participate. This portion of the program will in

great measure more firmly cement the fine friendship now existing between the dental professions in the neighboring countries to the south and the dental profession of the United States.

Those of you who are interested in entertainment and who wish to combine a vacation with the benefits of the convention can have any type of sport from deep sea fishing to golf; from swimming in salt water to wading in the local swimming pool; from hunting the largest wild game to shooting the local wild fowl. The environs of Houston are a sportsman's and vacation lover's Paradise.

This advanced information on the Annual Meeting is intended to reach you early with what this year's Annual Meeting has to offer, that your vacation planning may include the American Dental Association Annual Meeting in Houston, Texas, October 27, 28, 29, 30, 31, 1941.

Wilfred H. Robinson

COMMITTEE ON DENTAL PREPAREDNESS

SENATE BILL 783—THE MURRAY BILL

By previous statement it has been brought to the attention of the dental profession that the issuance of reserve commissions in the United States Army Dental Corps has been stopped. This action was taken by administrative order because the quota of the Dental Reserve Corps had been filled. Because of this action we are informed that approximately 102 dentists have been inducted into the army ranks, and are now serving as private soldiers in the army.

Thursday, March 13, 1941, representatives of the Dental Preparedness Committee of the American Dental Association appeared before representatives of the Adjutant General of the United States Army and presented the case of dentistry with the request that the quota of dental officers be raised to 8,000 men. The results of this conference seemed to indicate that the request would not be granted, hence it becomes imperative that steps be taken to attempt to obtain our objectives by legislation.

On February 6, 1941, Senator James E. Murray of Montana, introduced into the United States Senate, Senate Bill 783, which, if it becomes a law, will satisfactorily guarantee the employment of dentists in the army in their professional capacity only.

On March 14, 1941, the Dental Preparedness Committee was notified that a public hearing would be held before the Senate Military Affairs Committee on Senate Bill 783. On March 18, 1941, representatives of the Dental Preparedness Committee appeared before the Senate Military Affairs Committee and endorsed the Murray Bill (S. 783) with certain modifications.

It is important that the dental profession unanimously support this measure since it seems to be the only means of conserving the dental resources of the

nation. This support should be evidenced by letters to your Senators and Congressmen urging the immediate passage of Senate Bill 783, which was introduced by Senator Murray on February 6, 1941.

C. WILLARD CAMALIER, *Chairman*
GERALD D. TIMMONS, *Secretary*

REPORT OF THE CHICAGO MEETING OF THE COMMITTEE ON DENTAL PREPAREDNESS

THE open meeting held by the Committee on Dental Preparedness, Chicago, Ill., February 17, 1941, was called to order at 9:15 a.m., by the chairman, C. Willard Camalier. An address of welcome to the committee, chairmen and members of state military affairs committees, officers of societies, deans and others was delivered by Wilfred H. Robinson, President of the American Dental Association. Gerald D. Timmons, secretary of the committee, reported on the present status of the questionnaire on dental preparedness and answered numerous questions from the audience in relation thereto.

William H. DeKleine, medical director of the American Red Cross, discussed the cordial relationship existing between that organization and the American Dental Association, offering to cooperate in any desirable plan for dentally rehabilitating selectees who may have been rejected for physical defects.

The chairman introduced Leroy M. S. Miner, president of the American Association of Dental Schools, who discussed the question of the deferment of dental students until completion of their professional courses, and the fallacy of inducting graduate dentists into the army in unprofessional capacities. Dr. Miner was followed by John T. O'Rourke, dean of the University of Louisville Dental School, who elaborated on the foregoing questions, and presented the following statement for the approval of the group:

STATEMENT SENT BY AMERICAN DENTAL ASSOCIATION JOINT CONFERENCE ON PREPAREDNESS

TO

THE HON. HENRY L. STIMSON, SECRETARY OF WAR, WAR DEPARTMENT, WASHINGTON, D. C., AND MR. CLARENCE DYKSTRA, DIRECTOR OF SELECTIVE SERVICE, WASHINGTON, D. C.

It has been called to the attention of the American Dental Association Joint Conference on Preparedness that the Dental Reserve Corps of the Army has been closed and that no more commissions will be granted to present and future dental graduates. This would mean that graduates within the draft age limit, when called for military service, will be inducted as private soldiers, and not in a professional capacity. In view of the Preparedness Program as a whole, in both its immediate and its long-range aspects, and taking into consideration specifically the needs of the military service, the war industries and the civilian population, this would seem to be a needless waste of professional man-power at a time when the availability of dental personnel in the United States is decreasing.

Statistics show that there are approximately 21,000 dentists within the draft age. Of this number, it is estimated that 11,000 will be placed in Class 3, because of dependents, which leaves 10,000 men available for military service. It is estimated that of these 10,000, 3,300 may be disqualified because of physical defects, leaving 6,700 available in Class 1-A, Selective Service Classifications. With this extremely limited number of men to draw from in order to fill the requirements of dental service in the Army, it is obvious that no dentist should be called for military service in other than

a professional capacity. Therefore, we urge that:

1. The limit of the Dental Reserve Corps be increased from the present 5,100 to not less than 8,000.

2. In view of the fact that already there are graduate dentists inducted and serving in the Army as private soldiers, they be given an opportunity to apply for commission in the Dental Corps.

3. In order that an adequate supply of properly trained dental practitioners be available for the military services and the civilian population, deferment be extended to dental students and interns who have maintained satisfactory scholarship, until they have completed their period of professional training.

AMERICAN DENTAL ASSOCIATION,
JOINT CONFERENCE ON
PREPAREDNESS
C. WILLARD CAMALIER, *Chairman*
Chicago, February 17, 1941

This statement was duly approved and the chairman of the committee was directed to forward it by telegram to the Hon. Henry L. Stimson, Secretary of War, and Mr. Clarence A. Dykstra, Director of Selective Service.

The chairman presented Leonard George Rowntree, chief of the Medical Division, National Headquarters, Selective Service System, who delivered his address, as follows:

DENTISTRY AND SELECTIVE SERVICE

It is with deepest appreciation that we have accepted your invitation to participate in this program today, particularly as the invitation was accompanied by a statement that the American Dental Association wishes to do all in its power to aid in the work of Selective Service. This offer from you is comparable to others that we have had from the American Medical Association, the Army, the Navy, the Public Health Service and the Council on Medical Education and Licensure of the American Medical Association. It goes without saying that we are accepting your proffered aid and wish to take this occasion for expressing thanks.

Appearing before your experts in dentistry, I feel somewhat as a layman, notwithstanding the fact that we are closely associated in the operation of the Selective Service System, as our duties are interwoven and interdependent. Owing to the excellent work of the dentists of America, the health of this country has been widely preserved, and there is no doubt that you have added to the longevity of the population in general. Your function and importance in connection with military forces were clearly demonstrated during the last war. It was illustrated by the ever-increasing number of dentists, who were commissioned and ordered to large and small units, ranging from the great base hospitals to the battalions. In this connection, some of you who did not serve in the last war may be interested to learn that, on many occasions, dentists were under fire and rendered heroic service with combatant units. Dental officers with combatant units were directly under the regimental surgeon, and many times were assigned to first aid stations, just back of the front line and under constant shell fire. This detail was not entirely because of need of dental care, but rather because of their general medical knowledge acquired in medical contacts and in dental schools. The dentists were found to be invaluable assistants under such conditions, efficiently rendering first aid under the supervision of a medical officer.

However, the question which concerns us at this particular time is the very patriotic service that the dentists are rendering with Selective Service Medical Advisory Boards. A registrant may be found to be in excellent physical condition as far as the examining physician can determine, but later is turned down by a dental examiner on the Army induction board. It may be found that he has numerous excellent teeth in both the upper and the lower jaw, but that none of these are in apposition, and that it may be difficult, if not impossible, to produce dentures suitable for military service by artificial means. He may be equipped fairly well for civilian life, but is not acceptable for Army life.

According to the requirements outlined in Volume VI, Selective Service Regulations, only three classifications of physical fitness are provided, I-A, I-B and IV-F. The last class is for those disqualified for military service.

The examining physician is granted a rather great latitude of judgment as to what particular type of defect he will permit to continue to the induction centers for pos-

sible acceptance. In these induction centers, there will be well-qualified dental officers who will examine and perhaps pass the case, but it must not occasion surprise if some of them are returned as not fit for military service. Any defect must be readily and immediately remediable, for, on acceptance at the induction center, the man must be in condition to start military duties and live the regular and perhaps strenuous life of the barracks and Army mess hall. Through the service that your profession can give, it is hoped that a more nearly complete dental diagnosis can be made by the examiners for local boards, permitting a more equitable classification of registrants.

In order to fully understand the situation, it is desirable perhaps to outline the work of the Selective Service System. It consists of (a) procurement of men through registration, classification and examination leading to the induction, during the next five years, of 4,400,000 men for service with the Army and (b) procurement of facts relative to the health and social and economic status of approximately 16,500,000 registrants.

What is our modus operandi? 1. We have a local board of examining physicians supported by boards of appeal. 2. We have a state headquarters with a decentralizing function. 3. We have a national headquarters concerned chiefly with matters of guidance and administration.

What is our most effective working unit? 1. The local boards, about 6,400 in number. 2. About 18,000 examining physicians.

In this connection, we might state that we now recognize the importance of the mission of dentists with our local boards. The records now available of registrants show that the greatest cause of rejection has been dental defects. In Selective Service, 17 per cent of rejections have been based on dental defects, and 22 per cent of rejections at Army induction centers have been based on dental defects.

Unquestionably had dentists functioned with our local boards, the rejections for this reason by Selective Service would have been increased and those by the Army materially decreased.

In Selective Service throughout the country, there has been a growing demand for dental examiners. It is exceedingly gratifying, therefore, to receive through C. Willard Camalier, chairman of the National Committee on Dental Preparedness, and John T. O'Rourke, of the Council of National Defense, an offer to attach a dentist to all local boards desiring such service. Needless to say, there will be a great demand for this service.

In what way can dentistry help Selective Service? By securing competent dentists for the proposed additions to local boards and medical advisory boards.

What are the present major difficulties in regard to dentistry? There is a lack of dental training of the examining physicians of local boards and of thorough understanding of the requirements of the Army.

The importance that we now attach to the dental examination is so great that a dental advisory committee has been set up to guide us in all matters pertaining to dentistry. This committee includes: C. Willard Camalier, chairman, National Committee on Dental Preparedness; J. Ben Robinson, dean, University of Maryland Dental School, and William N. Hodgkin and Sterling V. Mead, members of the Legislative Committee, American Dental Association. Brig. Gen. Leigh C. Fairbank also has consented to serve on this committee and to direct us as to the standards required by the Army.

Simple as are the instructions in Selective Service Regulations, and strange as it may seem, considerable confusion has surrounded the counting of teeth and the decisions based upon their number and position. In this connection, a special chart has been devised by Selective Service, which simplifies the matter very considerably, and which, we hope, will be effective in overcoming some of the difficulties that have beset us to date.

There exists still another way, I think, in which you can be of help; namely, through having members of your profession participate in the medical preparedness programs. Teachers in the dental colleges are infinitely better qualified to present this material to the medical men than are the members of their own profession. It is our hope and desire that medical men arranging such programs make greater demands on you.

Among those who have rendered much aid to Selective Service are the psychiatrists of the country. In this field, an advisory board was created which accurately visualized our needs and furnished an instrument for the training of our medical exam-

iners relative to psychiatry. Of great help is a document that they have prepared, known as circular No. 1, in which is carefully set forth the requirements of the Army and the methods whereby psychiatric cases may be recognized. If the dental advisory committee will perform a similar service in its field, it will go a long way toward remedying the mistakes that we have been making.

In view of your proffered aid, it would not be amiss perhaps to suggest the situations in which you probably can serve to best advantage.

There is a growing tendency throughout the country in Selective Service to set up examining teams for group examinations. In such a connection, the dentist should find the place par excellence for exercising his professional ability.

We of the medical profession have a keen appreciation of the difficulties in which the profession of dentistry finds itself in this national emergency. Because of improved standards of admission, the number of dental students has been materially decreased. Where formerly the annual production of the medical schools was in the neighborhood of 2,400, it is now less than 1,600. In fact, the number of the dentists throughout the country as a whole is smaller than it should be—probably somewhat less than 70,000. The annual need for civilian service is about 2,400 dentists and the need for the Army will be about 3,000 a year for the next five years.

It would seem, therefore, that your need for deferment from military training is acute. It is our hope that some solution of the problem can be found. Needless to say, our attitude is one of sympathy and we desire to be as helpful as possible. It is our hope that the deferment of medical and dental students can be made as broad as possible to meet both civilian and military needs. The adjustment of this problem is going to require your active and intelligent assistance, including every contribution that you can possibly make in order to meet the demands of national defense.

At the present time, health rehabilitation is not our assignment. However, the studies carried on in Selective Service should reveal the magnitude and importance of the dental problem facing the nation and constitute the basis for an approach to the subject if rehabilitation is taken over as a national project. Certainly the dental profession, as a result of the work of Selective Service, is going to be faced with a large number of research problems—problems which should be investigated in the laboratories of the dental schools of the country.

In concluding, I wish to express to you the appreciation of Mr. C. A. Dykstra, director of Selective Service, for the help you have already rendered and for the assistance which you have so generously offered.

The chairman then presented Brig. Gen. Leigh C. Fairbank, chief of the Dental Corps, U. S. Army, who thanked the American Dental Association for its cooperation in the preparedness program and especially for the assistance given the Dental Corps of the Army. General Fairbank felt that with the cooperation of the Association and its affiliated groups, eventually the problems of the deferment of dental students until they had completed their courses in dentistry would be solved and the unfortunate induction of graduate dentists into the Army as private soldiers would be corrected. He further lauded Colonel Rowntree and the Selective Service for their appointment of an advisory committee and for the request that dentists be placed on all draft boards in the United States.

The audience was then given an opportunity to direct inquiries to the speakers and many interesting questions were propounded and answered.

Dr. Camalier, representing George H. Dunham, secretary of the Health and Medical Committtee, and chairman of the subcommittee on dentistry of that committee, gave a progress report on the survey of Army camps, defense industries and navy and marine stations, and displayed a map on which these various points were indicated. It was brought out that about one-third of these areas had been surveyed by the dental profession in the states involved. It was estimated that it would require at least another three months to complete the work.

The meeting adjourned at 12:30 p. m.

COUNCIL ON DENTAL THERAPEUTICS

PEPSODENT TOOTH PASTE, PEPSODENT TOOTH POWDER AND PEPSODENT LIQUID DENTIFRICE—OMITTED FROM A.D.R.

ANNOUNCEMENT of acceptance of Pepsodent Tooth Paste, Pepsodent Tooth Powder and Pepsodent Liquid Dentifrice (The Pepsodent Co., Chicago, Ill.) was made in THE JOURNAL (26:1893, November, 1939). The products were accepted on the basis of the Council's published rules.

The products were reviewed at the end of the first year of acceptance in accordance with the usual procedure.

The firm also formally requested reacceptance of Pepsodent Tooth Paste, Pepsodent Tooth Powder and Pepsodent Liquid Dentifrice. The firm, however, requested reacceptance of its dentifrices contingent upon the granting of concessions affecting general advertising. The Council is unable to accede to such requests.

In view of the foregoing, Pepsodent Tooth Paste; Pepsodent Tooth Powder and Pepsodent Liquid Dentifrice are declared unacceptable and are omitted from A.D.R. This Council action has been taken without prejudice to reconsideration in the future if such action should be warranted by scientific evidence.

CAROID DENTAL POWDER—NOT ACCEPTABLE FOR A.D.R.

Report of the Council on Dental Therapeutics of the American Dental Association authorized for publication.

THE Council's report on Caroid Dental Powder was submitted to the American Ferment Company in order that the firm might have an opportunity to present suggestions and comments in reply to the Council's report. The referee has examined the firm's reply and finds that it does not contain evidence which would warrant a fundamental change in the nature of the report.

The firm has stated that it is gathering evidence and experimental data designed to substantiate claims made in advertising. In view of the fact that promotion of the product is being continued, and particularly in view of numerous requests for information from members of the dental profession, the Council is publishing the following report.

A request for scientific information on Caroid and Caroid Dental Powder, addressed to the American Ferment Company several months ago, remains unanswered. The firm's advertising literature states that ". . . the complete formula is furnished to physicians and dental surgeons." It is to be noted that the firm failed to respond to the Council's request for information on the composition and properties of Caroid Dental Powder.

Caroid Tooth Powder is said to contain the "fruit ferment—Caroid" which is acknowledged to be the "Digestive Ferment of Carica papaya." Apparently, "Caroid" is essentially the same as the proteolytic enzyme known under the non-proprietary designation papain.

Papain and papain-like enzymes are rather widely distributed in the plant world. A common source of papain is Carica papaya, but papain-like substances

have been detected in lima beans, wheat flour, milkweed and other substances. Papain, which has recently been obtained in a crystalline state, is hydrolytically active (on all substrates) only in the reduced state. Some data have been advanced to show that papain in the oxidized state hydrolyzes egg albumin, but not certain peptones.

Crystals of papain that were isolated recently were found to contain three forms of enzyme: (1) an active form; (2) an inactive form that may be activated with cysteine or cyanide, and (3) an inactive form not so activated. Apparently, the proportions of forms vary with the method of preparation and treatment. Activation of papain is accomplished with such agents as cyanides, thioglycollic acid, thiohydracrylic acid and dithioglycollic acid (the last in alkaline solution.) Zinc is inhibitory.

From the evidence available at present, it may be deduced that crystalline papain resembles prolamine. Like prolamine, it is soluble in 70 per cent alcohol and without injury to its activity. The molecular weight of the enzyme is in the neighborhood of 30,000. In the molecule, there appears to be but one active sulfhydryl group.

Those who are interested in obtaining further technical information on papain may consult a review by A. K. Balls (*Ann. Rev. Biochem.*, Vol. IX, 1940).

Preparations containing papain were rather widely used in medical practice thirty or forty years ago. In a special article, Sollmann (*J.A.M.A.*, 49:522, February 9, 1907) pointed out that papain was being used in the treatment of achlorhydria, but that its value in this condition was slight. This authoritative opinion relative to the efficacy of administration of papain has apparently not been changed in the intervening period as is indicated by the brief mention of papain in Sollman's "Manual of Pharmacology."

Other authors of textbooks of pharmacology have indicated the limited usefulness of papain in medical practice. In Cushny's "Pharmacology and Therapeutics," revised by Edmunds and Gunn, the following is found:

It has been used instead of pancreatin and pepsin in disorders of the digestion, and also as an anthelmintic. Diphtheritic membranes have been treated by the frequent application of papain solution; the underlying disease was not favorably influenced, however, and the treatment has been abandoned. Papain solution has also been injected by the hypodermic needle into tumors and abscesses, with the intention of digesting the new growth, or accelerating the progress of the abscess toward the surface, but the results obtained do not encourage its further use. Peptones are unquestionably formed in the tumors when papain is injected.

Neither papain nor Caroid is described in the current issue of "New and Nonofficial Remedies" (American Medical Association). Inasmuch as members of the dental profession appear to be exposed to the same or similar advertising material on Caroid and preparations containing it as are the members of the medical profession, the Council deems it pertinent to present the following section on Digestive Enzymes (N.N.R. 1940, p. 193):

As a result of the replies to a questionnaire sent to the members of the American Gastro-Enterological Association, W. A. Bastedo reported (*J.A.M.A.*, 85:745 [Sept. 5] 1925) that many members of the association do not prescribe digestive enzymes, while those who do employ such enzymes confine their use almost wholly to cases of demonstrated or believed enzyme deficiency; almost all who prescribe them show no great enthusiasm over the results of their use, except possibly in case of pancreatin in proved pancreatic deficiency.

In consideration of the replies to the questionnaire, and in consideration of the fact that no favorable evidence has since become available, all digestive enzyme preparations have been omitted save those recommended for use outside the body for the digestion of food previous to administration

and locally for the softening of dead tissues or the solution of false membranes.

While the recent medical literature contains some preliminary reports indicative of the possible value of papain, the findings are still inconclusive. Illustrative of some of these reports is a paper by Ochsner and Storck. *(Ann. Surg.,* 104:736, October 1936.) In a study of 231 cases, these investigators found that papain is of value in the prevention of peritoneal adhesions. The authors did, however, state that "obviously, a long period of observation and a much larger group of cases is necessary before final conclusions concerning the value of papain can be drawn."

So far as the Council is aware, the dental literature contains no reports of reliable experiments showing the usefulness of caroid or products containing it in dental practice. Whether the digestive ferment in Caroid Tooth Powder exerts a significant effect under the conditions of use has apparently not been established. Nor has it been shown that such digestive actions, if attainable, are either necessary or desirable.

Digestive ferments are apparently applied locally in medical practice, but this form of medication is by no means widely employed. Of the products standing acceptable to the Council on Pharmacy and Chemistry, none is of vegetable origin. Attempts to show the superiority of Caroid over other proteolytic enzymes in current advertising on caroid may be misleading, in the Council's opinion. A comparison of Caroid with pepsin under conditions unfavorable to the latter is not of much value in the determination of the efficacy of Caroid for local application. For this purpose, it would appear reasonable to require direct clinical comparisons of Caroid with recognized digestive enzymes such as those listed and described in official compendia and in "New and Nonofficial Remedies." Balls and Lineweaver *(J. Biol. Chem.,* 130:669, October 1939) have stated that there is no marked difference between proteinases elaborated by animals and those elaborated by plants.

In view of the fact that Caroid in Caroid Dental Powder exists in combination with other ingredients, and because of the prescribed directions for use of the tooth powder, it is of interest to examine the findings of the Bureau of Chemistry. Commonly used chemical procedures for determination of the activity of papain indicate that the proteolytic activity of Caroid Tooth Powder is slight.

REPORT OF THE BUREAU OF CHEMISTRY

Five packages of Caroid Dental Powder were purchased on the open market, price 48 cents each. One of the packages had a corrugated liner and a proportionately larger carton than the other four. The five cans were all apparently the same size.

The reading matter on the cans was as follows:

Caroid Reg. U. S. Pat. Off. Dental Powder. A highly efficient preparation for cleansing the gums and teeth. The American Ferment Co., Inc., Buffalo, N. Y., U. S. A.

Directions: Upon arising, first rinse the mouth with water. Now shake into palm of hand as much Powder as you can pile upon a 25 cent piece, and take up gradually on the wet toothbrush.

Brush teeth thoroughly on both inner and outer surfaces, working the bristles up and down so every crevice is reached. Do Not Rinse the mouth. Allow the Powder to remain in the mouth at least 5 to 10 minutes, or while completing your toilet, expectorating occasionally the surplus saliva. The longer retained, the better results. When leaving the bathroom, expectorate mouth contents, But Do Not Rinse The Mouth.

Do This Three Times Daily—Read Carefully The Booklet—Keep Cap Tightly Closed. New style package adopted April, 1938. Av. Net Wt. 2 oz.

There was a considerable air space above the powder in each can; i. e., about 30 per cent of the total volume of the can. The quantity of powder per can was 2 ounces, as declared on the

label. The contents of five cans was bulked for analysis.

The product was a powder, almost white. Qualitative examination indicated the presence of: calcium, sodium, magnesium, carbonate, higher fatty acid salts, phosphate and a proteolytic enzyme.

Quantitative analysis yielded the following:

pH of slurry with water	8.82
Per cent calcium oxide (CaO)	33.9
Per cent magnesium oxide (MgO)	2.06
Per cent sodium (Na)	3.08
Per cent higher fatty acid	14.0
Per cent carbon dioxide (CO_2)	30.6
Per cent moisture (over P_2O_5)	5.77
Per cent phosphate (P_2O_5)	0.028
Per cent ether soluble	5.0
Sulfated ash	0.983 gm./gm. sample

The proteolytic activity of the Caroid Dental Powder was tested by the milk-clotting method of Balls and Lineweaver (*J. Biol. Chem.*, 130:669, October 1939) and by the Association of Official Agricultural Chemists' tentative method of assay for papain (*J. A. Official Agr. Chemists*, 21:97, February 1938). A commercial preparation of powdered papain was used as a control. The milk-clotting activity of the sample of Caroid Dental Powder was found to be less than one-twentieth that of the commercial preparation of papain. Preliminary results obtained by the tentative A.O.A.C. assay method appeared to follow a similar pattern. (End of chemist's report.)

On the basis of the report of the Bureau of Chemistry, it may be deduced that the composition of Caroid Dental Powder is essentially as follows:

	Gm.
Calcium carbonate	60.6
Magnesium oxide	1.4
Magnesium carbonate	1.4
Sodium bicarbonate	6.7
Soap	15.3
Papain	5.0
Moisture and flavoring To make	100.0

In the light of the foregoing, Caroid Dental Powder, which is essentially a chalk-soap dentifrice containing a proteolytic enzyme, is declared unacceptable for A.D.R.

A copy of the rules that govern the Council in the consideration of articles will be sent on request.

HAROLD L. HANSEN, *Secretary.*

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

HAROLD L. HANSEN, *Secretary.*

Dentifrices

Klinodento Tooth Paste: Composition: See Sheffield Tooth Paste (A.D.R. Ed. 6, p. 120).

Manufactured by the Sheffield Company, New London, Conn. Distributed by Dr. J. Toro Hernandez, San Juan, Puerto Rico.

Ace Tooth Paste: Composition: See Comfort Brand Tooth Paste (A.D.R. Ed. 6, p. 115).

Manufactured by the Comfort Manufacturing Company, Chicago, Ill. Distributed by Ace Manufacturing Co., Chicago, Ill.

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information on the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

BUREAU OF PUBLIC RELATIONS

COLORADO'S DENTAL HEALTH WEEK

COLORADO's Dental Health Week was sponsored by the Colorado State Board of Health and the Denver Dental Association and held in conjunction with the Rocky Mountain Midwinter Dental Meeting, January 26 to 29.

Initiated by a joint proclamation by the governor and the mayor, the program received the active cooperation of newspapers, radio stations, merchants, the retail credit men's association, the parent-teacher association, schools, street car and taxicab companies.

Dental health exhibits were displayed at the Shirley Savoy Hotel from 10 a.m. to 10 p.m. A poster and an essay contest was held in the high schools, the winners of which, besides receiving small monetary awards, were presented to the governor, who was guest of honor at the banquet attended by the winners.

One hundred and fifty posters were enlarged and displayed on streetcar fronts and one hundred and fifty more were displayed in downtown stores. One hundred bumper signs were carried by Yellow Cabs. Retail druggists in the residential districts cooperated by presenting special dental window displays furnished by the wholesale drug houses and two window-trimming agencies. The parent-teacher association, through their general health chairman and their 200 local presidents, sent verbal and written announcements to every member. Civic and service clubs allowed time on their programs for short dental health lectures. Highschools and several grade schools permitted pupils to attend the exhibits and gave each child who attended one hour's credit in science.

Radio station announcers read short dental health messages prepared and

Fig. 1.—Poster and Essay Contest exhibit.

sponsored by the state board of health. So well was the program prepared, publicized and presented that the public's response was excellent. The exhibit hall was crowded during afternoons and evenings and numerous requests were received from various groups for the use of the exhibit material.

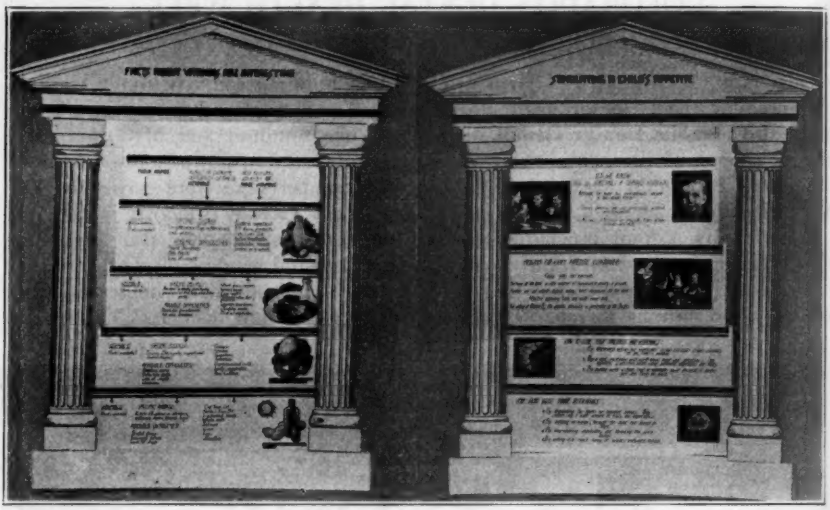


Fig. 2.—Personality House.

How American Public Spent their Money Last Year
Food $17,000,000,000
Clothing 8,000,000,000
Gambling & Race Track 7,000,000,000
Autos 6,600,000,000
Beer and Liquor 2,610,000,000
Movies 2,000,000,000
Tobacco $1,600,000,000
Cosmetics & Silk Hosiery 1,345,000,000
Sports and Games 900,000,000
Dog Bills & Veterinarian Fees 601,100,000
Candy and Confections 400,000,000
DENTAL SERVICE $400,000,000
Coca Cola $60,000,000
DENTIFRICES AND MOUTHWASHES $29,500,000
IS IT NOT IMPORTANT TO PRESERVE HEALTH THROUGH SCIENTIFIC DENTAL SERVICE?

Fig. 3.—Exhibit prepared by professional group, Retail Credit Men's Association.

CHILDREN'S DENTAL HEALTH WEEK IN AKRON, OHIO

CHILDREN'S Dental Health Week opened in Akron, Ohio, February 3 and was officially proclaimed by Mayor Lee D. Schroy. In his proclamation, the mayor urged all Akron citizens to recognize the importance of dental care for children in order to insure health and freedom from disease.

Dental Health Week was sponsored by the Akron Dental Society. The program received excellent cooperation from the board of education, parent-teacher association, business organizations, newspapers and radio stations. Akron dentists initiated a program to inspect the teeth of 28,128 elementary school children. The society distributed more than 30,000 educational leaflets and dental health guides in the schools. It furnished each dentist with a 3 by 5 foot sign for his reception room proclaiming dental health week. Three-foot banners were furnished Akron's 150 druggists, who used them effectively in window displays.

Prominent downtown merchants featured dental exhibits and displays in their show windows. Newspapers carried feature articles and the radio stations carried six feature broadcasts. The regular monthly meeting of the society was devoted to dentistry for children.

John C. Brauer, of Iowa City, was the principal speaker and clinician.

CHILDREN'S DENTAL HEALTH DAY IN CLEVELAND, OHIO

CLEVELAND, host city of the first school dental program back in 1906, was first again in sponsoring Children's Dental Health Day in an all day and evening program, Monday, February 3, at Hotel Statler.

Harvey J. Burkhart was guest of honor as 550 registrants eagerly sought the wealth of information which such outstanding men as John C. Warnock, Theodore C. Blutau, Arnold D. Mason, dentist to the Dionne quintuplets, James N. Gasaway and John C. Brauer had to offer on their respective subjects.

Mayor Edward Blythin issued his first official proclamation after taking office in proclaiming "Children's Dental Health Day in Cleveland." In his comments at the Monday luncheon, he expressed a keen interest in this event and predicted a widening of enthusiasm in the field of children's dentistry. The realization of the mayor's predictions was already in evidence as it was then announced that the Akron Dental Society had taken up the banner and was planning a similar event.

The Cleveland Dental Society Orchestra made history for itself and for the society by appearing at both the luncheon and the dinner meeting with programs enjoyed by all assembled, including the many out-of-town guests present.

Also in attendance at the luncheon were representatives of all of the outstanding civic and welfare organizations of Cleveland.

Plans are already under way to repeat the event in 1942.

AMERICAN DENTAL ASSOCIATION

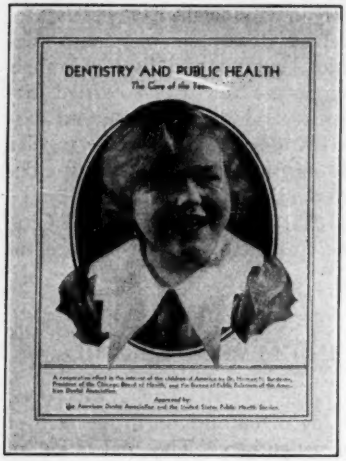
212 East Superior Street
Chicago, Illinois

DENTAL HEALTH EDUCATIONAL MATERIAL

(Continued from page 482 of the March, 1941, issue.)

51. BOOKLET ON CARE OF THE TEETH

Attractive 32 Page Booklet



Written in lay language, illustrated with eighty photographs of actual cases and models. Each illustration tells its own story. Approved by the American Dental Association and the United States Public Health Service.

Prices—10c per single copy; 12 copies—$1.00; 50 copies—$4.00; 100 copies—$7.50; 500 copies—$25.00; 1,000 copies—$45.00.

A BENEFICIAL PRODUCTION CIRCLE

52. DENTAL HEALTH POSTERS

Twice a year we come to town
Just to visit Dr. Brown
Dr. Brown our teeth inspects
And keeps them free from all defects.

Four 22 x 28 inch posters, in color (only one of which is shown), emphasizing four dental health rules for the care of the teeth; proper food, exercise, cleanliness and regular dental attention.

Approved by the American Dental Association and the United States Public Health Service.

1 Set—$1.00
10 Sets—90c per set.
25 Sets—85c per set.
50 Sets—75c per set.
100 Sets—60c per set.

A BENEFICIAL PRODUCTION CIRCLE

53. DENTAL HEALTH CHARTS

Eight large charts, designed for high school and adult teaching.

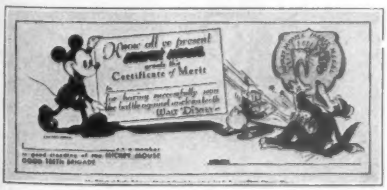
Subjects covered: The teeth; the deciduous teeth; the permanent teeth; diet and teeth; dental care; mouth hygiene; preventing decay of the deciduous teeth; preventing decay of the permanent teeth.

Beautifully illustrated in five colors and bound with modern spiral binding into one complete dental health educational unit. 22x29 inches in size, each chart consists of one 14 inch illustration accompanied by suitable descriptive text.

1 Set—$1.00
10 Sets—90c per set
25 Sets—85c per set
50 Sets—75c per set
100 Sets—60c per set

54. MICKEY MOUSE MATERIAL

The 4 color 1¼ inch safety clasp Mickey Mouse Buttons are sold 20 for 75c. In lots of 100 or more 2½c each. The 4 color 4 x 9 inch certificates sell for 1c each in lots up to 500, 500 for $4.75, 1,000 for $9.00.



"Clean teeth" Certificate—to be given children who have kept their teeth clean for a specified length of time.

"Good teeth" button—to be given children who have had all dental defects corrected.

54d. PINOCCHIO MATERIAL

The 4 color 1¼ inch safety clasp Pinocchio Buttons sell for 20 for 75c. In lots of 100 or more 2½c each. The 6 color 4 x 9 inch certificates sell for 1c each in lots up to 500, 500 for $4.75, 1,000 for $9.00.

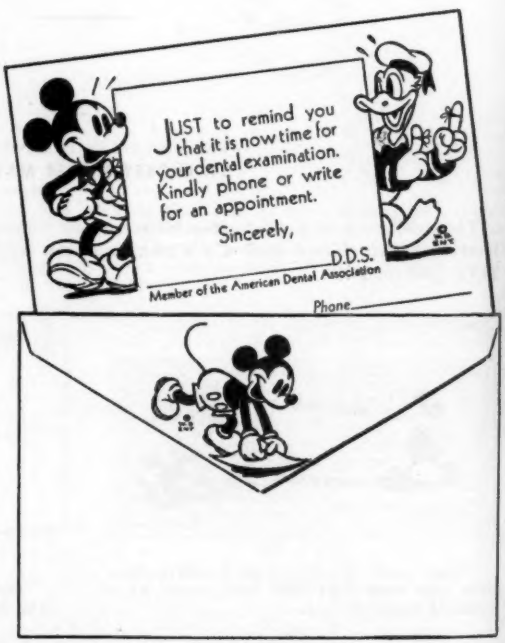
Pinocchio Good Teeth Buttons—20 for 75c.

Pinocchio Good Teeth Certificates—1c each.

55. CHILDREN'S DENTAL RECALL CARDS

Let Mickey help you remind your child patients that it is time for a reexamination.

50 cards and envelopes $1.50.
100 cards and envelopes $2.00.


JUST to remind you that it is now time for your dental examination. Kindly phone or write for an appointment.
Sincerely,
D.D.S.
Member of the American Dental Association
Phone

56. BLOTTERS

These six blotters, illustrated in 2 colors, are reproductions of winning designs submitted in the NATIONAL POSTER CONTEST.

Can be mailed monthly to patients—
or given to children for school use.

Sample Set of 6, 10c

25	Sets (150 blotters)	$2.50
50	Sets (300 blotters)	$4.50
100	Sets (600 blotters)	$7.50

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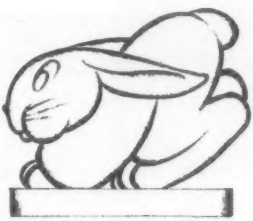
57. PLASTER-KASTER SETS
SPLIT RUBBER MOLDS OF
SNOW WHITE, THE SEVEN DWARFS, PINOCCHIO
JIMINY CRICKET, SANTA CLAUS AND RABBIT

3¾" in height

4" in height

3½" in height

3¾" in height



2¾" in height

5¼" in height

SNOW WHITE 75c—DWARFS 50c each—PINOCCHIO,
JIMINY CRICKET, SANTA CLAUS and RABBIT 50c each
MOLD CLAMP 25c each or 2 for 40c

57a. FLAT RUBBER MOLDS

3¾ inch Flat Rubber Molds. Famous Funnies: Orphan Annie, Smitty, Dick Tracy, Winnie Winkle, Gasoline Alley, The Gumps, Harold Teen, Terry, Tiny Tim, Little Joe, Moon Mullins.....$1.35 per set; 15 cents per mold.

Famous Americans: G. Washington, A. Lincoln, T. Roosevelt, T. Jefferson, B. Franklin, U. S. Grant, D. Webster, W. Rogers.....$1.60 per set; 25 cents per mold.

National Characters: Indian, Hawaiian, Dutch Boy and Girl, Uncle Sam, John Bull, Bohemian. .....$1.40 per set; 25 cents per mold.

Animals: Bear, Chicken, Dog, Elephant, Horse, Lion, Monkey...$1.75 per set; 30 cents per mold.

58. DAILY RECORD OF GOOD HEALTH HABITS

It's wrapped in sparkling cellophane! Size 14 x 11 inches. There are twelve monthly record sheets firmly wire-stitched to a sturdy cardboard base, printed in five colors. On the reverse side are Weight—Height—Age tables and helpful suggestions to parents for making the chart effective in building good health and behavior habits in their children. Price 35c.

59. TEETH, HEALTH AND APPEARANCE

TEETH, HEALTH AND APPEARANCE

This beautiful book answers most of the more important dental questions. Indispensable for office, school and library. Authoritative, artistic, informative, inexpensive.

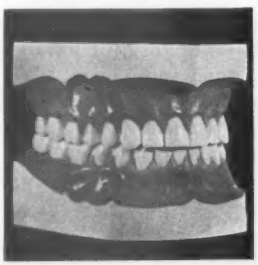
Forty-eight 10½ x 14 inch pages illustrated with one hundred and one pictures, fifty of which are in four colors. Case bound cloth cover only $1.50 postpaid.

LATEX MODELS OF UPPER AND LOWER TEETH

THESE large new models have been developed to supply the many requests received from dental hygienists and others for teaching and toothbrushing models.

They are eight inches high and eight inches wide. Made of latex, they are both durable and light and should prove very practical for demonstration purposes.

They sell for $10.00 per set. They may be rented for $1.00 per week from the Bureau of Public Relations, American Dental Association, 212 E. Superior St., Chicago, Ill.



Special Notice: To assist the Bureau in eliminating unnecessary bookkeeping and correspondence, *please order by number and remit the amount of your order at the time of ordering.* Remit by postoffice money order or stamps. *Please do not send personal checks for amounts of less than one dollar.*

COMMITTEE ON LEGISLATION

BILLS INTRODUCED IN STATE LEGISLATURES—1941

ARIZONA

Bills introduced: H. 1 proposes the consolidation of all existing agencies relating to public health into a new state department of health. H. 176 provides that the dental board shall not revoke any license prior to final determination of appeal by the court to which it is appealed.

ARKANSAS
Adjourned March 13

Bills introduced: S. 210 provides that any professional person who has had his license revoked for from one to three years may obtain a probationary reinstatement for one year, and full reinstatement if he does not violate the probation. S. 291 would give a 10 per cent credit to all "veterans of Army, Navy, Marines and Nurses" who take examinations for professional licenses.

CALIFORNIA

Bills introduced: A. 562 authorizes existing non-profit medical service corporations to enter into contracts with any instrumentality of the United States. A. 635 repeals sections 6622 and 6623 of the Welfare and Institutions Code relating to dental services at state institutions. S. 720 proposes an amendment to the section authorizing the dental board to revoke licenses for unprofessional conduct. The amendment states that the board shall also be permitted to revoke the license of a dentist who violates any of the rules and regulations of the board. A. 977 proposes that the state board of health be supplanted by a director of public health who shall assume all the duties, powers, etc., of the board of health. A. 1449 amends the Business and Professions Code relating to powers and duties of the board of dental examiners and gives the board power to enforce its rules and regulations, as well as the existing power to adopt such regulations. A. 1450 amends the dental law to require persons who have failed to pass the licensing examination three times to take another year of schooling before trying again. A. 1625 proposes the establishment of a medical and dental program for the needy through the use of state and county funds. An administrative board of five members shall include two dentists. S. 645 proposes the establishment of a health insurance system under the Unemployment Insurance Act. The following dental services are to be provided to the extent permitted by the financial resources of the medical benefits account: (1) extraction of teeth; (2) treatment of osteomyelitis; (3) treatment of trench mouth; (4) treatment of jaw fractures and (5) treatment of inflammatory conditions of the oral cavity. Preventive dental care for children between the ages of 2 and 5 is to be included if federal assistance for such care becomes available. This care would be given in diagnostic centers by licensed dentists. A. 2471 proposes the establishment of a tax-supported system of health insurance. S. 1130 proposes that any one who employs a dentist for less than $100 a month shall be guilty of a misdemeanor.

COLORADO

Bills introduced: S. 214 proposes the creation of a full-time cooperative local public health service in Colorado on a county or district basis. H. 158 would require citizenship as a requisite for obtaining a license to practice medicine,

dentistry, chiropractic, embalming and chiropody.

CONNECTICUT

Bills introduced: S. 210 provides that no requirement as to formal education shall be established for civil service examinations except that physicians and dentists shall be licensed to practice medicine or dentistry in this state or shall be eligible for such license. S. 342 and H. 112 propose to change the existing law so that it will be necessary for physicians and dentists to be licensed in order to be eligible for employment by the state. S. 529 (H. 1979) proposes the enactment of a health insurance system that would provide dental service only for relief of pain, under general benefits. S. 1196 proposes the elimination of certain of the restrictions on advertising. S. 1378 (H. 478) would permit dentists licensed in other states to present clinics within the state of Connecticut. S. 1394 (H. 494) would permit the dental commission to regulate the size of dental signs and the size of the lettering on the signs. S. 1397 revises the definition of what constitutes the practice of dentistry and prohibits the construction of dentures except by a licensed dentist or on the prescription of a licensed dentist. S. 1414 (H. 514) would require all applicants for licenses to practice dentistry to be United States citizens or have declared the intention of becoming a citizen.

DELAWARE

Bills introduced: S. 15 proposes that dentists, physicians and other persons and hospitals be given the right to exert a lien for the value of professional services rendered to persons injured through the fault or neglect of others. The lien may be exerted against the person responsible for the injury.

GEORGIA

Bills introduced: S. 11 would prohibit the use of the title "Dr." or "Doctor" on letterheads, signs, etc., without also indicating the particular degree held by the person mentioned. It would also limit the size of lettering on signs or doors to 2½ inches in height and 1 inch in width. S. 152 proposes that the practice of dentistry, medicine, architecture, etc., without a license shall be declared a public nuisance and subject to immediate abatement. S. 157 regulates the manufacture, sale, possession, etc., of narcotic drugs. H. 158 proposes to permit dentists from outside states to give clinics and demonstrations before dental societies and associations without a license.

ILLINOIS

Bills introduced: H. 12 proposes that persons who are not citizens of the United States shall not be given licenses to practice dentistry. H. 58 proposes that dentists shall be prohibited from operating more than one office unless they personally supervise the work of each office.

INDIANA
Adjourned March 10

Bills introduced: S. 90 proposes the creation of a state council of health composed of seventeen members, one a dentist, to aid and advise the state board of health.

Laws enacted: H. 349 requires that all actions for damages against physicians, surgeons, dentists, hospitals and sanitariums must be filed within two years of the date of the action complained of.

KANSAS

Bills introduced: S. 246 would require all dentists in cities with a population of 115,000 or more to pay an annual fee of $10. The fees collected are to be used to develop and maintain a dental library in the city. H. 245 proposes a revision of the Workmen's Compensation law.

The revised act would include dental care and appliances among the services which employers must provide for injured employes.

MAINE

Laws enacted: H. 676 amends the dental practice act to prohibit various types of advertising by dental laboratories or dental technicians. It also includes in the definition of the practice of dentistry any one who shall "furnish, supply, construct, reproduce, or repair prosthetic dentures, crowns, bridges, appliances or other structures to be used and worn as substitutes for natural teeth," except on the prescription of a licensed dentist. The law also provides that the members of the board shall receive $10 a day and necessary expenses in the discharge of their duties.

MASSACHUSETTS

Bills introduced: H. 130 proposes that the sale of barbituric acid and its derivatives and certain other sedatives shall be restricted to physicians, dentists, veterinaries, hospitals and schools. H. 1477 would permit the establishment of medical service corporations. A majority of the directors of such corporations must be members of a medical society in existence ten years and with at least 2,000 members. H. 2010 relates to the salaries of dentists at state institutions.

MISSOURI

Bills introduced: H. 62 requires all persons licensed to practice the healing arts to indicate the title or degree held whenever they use the prefix "Dr." or "Doctor" on signs, letters, prescriptions, advertisements, etc. H. 166 would amend the dental practice act to permit an action by injunction against a person practicing dentistry without a license.

MONTANA
Adjourned March 6

Bills introduced: S. 24 proposed the enactment of a law creating a state board of basic sciences that would conduct examinations in anatomy, physiology, chemistry, bacteriology and pathology that must be passed by every person desiring to obtain a license to practice one of the healing arts. H. 50 proposed the enactment of a law preventing the manufacture, shipment and sale of adulterated or of misbranded foods, drugs, devices and cosmetics and would prevent false advertisement of foods, drugs, devices and cosmetics.

Laws enacted: H. 47 revises the dental practice act to require that all applicants for licenses to practice shall be United States citizens. It also revises and broadens the definition of what constitutes the practice of dentistry.

NEVADA

Laws enacted: S. 6 amends the dental practice act dealing with the revocation of licenses of dentists for unprofessional conduct including the following practices: advertising painless dentistry, fixed prices, free service, guaranteed work, professional superiority or use of any particular medicine or system. The amendments also state that public demonstrations of skill, fraud in securing licenses, violation of board of health rules, division of fees, use of the name, clinic, institute, etc., failure to pay a license fee or aiding an unlicensed person to practice all constitute unprofessional conduct.

NEW HAMPSHIRE

Bills introduced: H. 262 proposes to exempt students working in class A hospitals under the supervision of a registered dentist from the provisions of the dental practice act. H. 278 relates to the practice of dentistry.

NEW JERSEY

Bills introduced: A. 38 proposes amendments to the section which states the grounds on which a dental license may

be revoked and also to the definition of what constitutes the practice of dentistry. A. 49 provides tenure for medical inspectors, physicians and dentists in schools in first-class counties.

NEW MEXICO

Bills introduced: H. 14 amends the Workmen's Compensation Act in several respects. The bill proposes that dental care shall be furnished by the employer to the value of $500 unless the employe refuses to accept it. The bill also provides that in all cases wherein an injury is such as to permit the use of artificial members, including teeth and eyes, the employer shall furnish them. H. 123 proposes the enactment of a basic sciences act.

NEW YORK

Bills introduced: S. 313 and A. 371 propose the establishment of a health insurance fund in the health department to be maintained by payroll taxes on the employe and employer and by state contributions. The system proposed will provide various medical, dental, hospital, maternity and cash benefits. The regular medical benefits include "(g) dental services for the relief of pain through surgical intervention." More extensive dental care is provided for under "additional medical benefits," which are to be made available if funds are available. A. 612 proposes the establishment of a temporary commission to make a survey of the dental needs of inhabitants looking toward a long range dental program.

NORTH CAROLINA

Bill introduced: H. 549 proposes that radiology be included in the definition of the "practice of medicine," but does not forbid practice of radiology by dentists.

OHIO

Bills introduced: H. 45 proposes that two or more boards of education may combine to hire doctors or dentists. H. 97 would prohibit the advertising and sale of artificial teeth by dental laboratories to persons other than dentists.

OKLAHOMA

Bills introduced: S. 13 proposes that the membership of the Committee on Standardization of Hospitals for Crippled Children be increased to include a dental member. S. 151 provides amendments to the uniform narcotic drug law.

OREGON

Bills introduced: H. 203 proposes a complete system of health insurance. Contributions are to be made by employers, employes and the state. Among the regular benefits included are the following dental benefits: "5(g) dental services for the relief of pain through surgical intervention." More nearly complete dental care is provided for under additional medical benefits, which are only available if surplus funds are available. H. 345 proposes that women be licensed as dental hygienists to work under the supervision of licensed dentists. H. 361 would prevent a professional person from having the name of a deceased person on a door or letterhead or elsewhere, for more than one year after the person's death.

RHODE ISLAND

Bills introduced: S. 51 proposes an amendment to the Workmen's Compensation Act to increase the amount of medical, dental and hospital care which the employer must furnish injured employes. Dental service is defined as "services rendered in making, repairing and replacing artificial teeth and dentures."

SOUTH DAKOTA
Adjourned March 7

Bills not passed: S. 252 proposed an amendment to the law regulating dental hygienists, to permit reciprocal licensing. S. 253 proposed amendments to

the section providing for annual registration of dentists. S. 254 proposed amendments to the section prohibiting advertising by dentists.

TEXAS

Bills introduced: S. 210 (H. 659) proposes the elimination of a number of the restrictions on advertising by dentists. S. 214 proposes that it shall be the duty of the state department of health to enter into agreements with all willing physicians and dentists for the purpose of providing care for destitute children. State medical and dental societies shall supply fee schedules considered fair and equitable, to be used in working out programs in conjunction with component societies. H. 701 would permit the establishment and operation of non-profit medical and surgical care plans on a prepayment basis.

UTAH

Bills introduced: S. 13 proposes amendments to the section of the dental practice act defining unprofessional conduct as follows: (1) advertising his dental business or treatment or devices by untruthful, improbable or impossible statements, or advertising in any manner except by the use of newspapers, periodicals, signs, cards, radio and other lawful means of advertising, provided definite fixed prices or charges to be made be advertised in the manner and by the means herein above specified and further provided the advertising in any manner or by any means whatsoever as in this act provided shall be only in the name of the licensed dentist and (2) failing to keep his price list of all dental operations of both minimum and maximum prices in a conspicuous place in his reception room, and at each dental chair in his dental office. The price list shall be in letters not smaller than 1 inch, and if the dentist employs a commercial dental laboratory to do his prosthetic work, the price list of the laboratory shall be attached thereto. S. 59 proposes the transfer of the enforcement of the uniform narcotic drug act and of the prophylactic control act from the Department of Registration to the Board of Pharmacy. S. 67 is a special act dealing with compensation for employes who contract occupational diseases. The diseases deemed to be occupational are set out in the bill. The law applies only to employers with three or more employes. S. 92 proposes the appointment of a basic science board to conduct examinations in anatomy, physiology, chemistry, bacteriology and pathology. This examination must be taken by every person desiring to obtain a license to practice any one of the healing arts. S. 93 proposes an amendment to the sales tax law imposing a 2 per cent tax on professional, technical and scientific services. H. 45 provides for the organization of cooperative associations formed to provide medical, dental, hospital and related services for their members.

VERMONT

Bills introduced: H. 160 proposes the establishment of a basic science act with a five-man examining board in the basic sciences. S. 52 would permit any three dentists to form non-profit corporations for the purpose of providing dental services to subscribers.

WASHINGTON

Bills introduced: S. 247 proposes the establishment of a compulsory health insurance system. Regular dental benefits would be limited to "dental services for the relief of pain through surgical intervention." More extensive dental care may be provided if funds are available. H. 368 proposes amendments to the dental practice act. It would require the governor to make selections for members of the dental board from a list of five names submitted to him by the state

dental society for each vacancy. Members of the board must be citizens of the United States. The amendments would also require all applicants for licenses to practice dentistry to be United States citizens or to have declared the intent to become citizens. The amendments also state that the medical board shall have the power not only to make, but also to adopt such rules and regulations as it deems necessary to enforce the act. (This bill has passed both houses and is in the governor's hands.)

WISCONSIN

Bills introduced: A. 185 provided for the repeal of the section granting the board power to make such rules and regulations as it might deem necessary for properly governing the practice of dentistry. This bill was killed in the assembly. A. 337 provides that whenever a license is required for the privilege of engaging in any commercial enterprise, such license shall not be issued to any one who is not a United States citizen.

RESEARCH COMMISSION

REPORT OF THE RESEARCH COMMISSION 1939-1940

To the Officers, Board of Trustees and House of Delegates of the American Dental Association:

AT the annual meeting of the American Dental Association held in Milwaukee, Wisc., July 17-21, 1939, an appropriation in the amount of $17,000 was given to the Research Commission to cover expenses for the fiscal year beginning July 1, 1939 and ending June 30, 1940.

The Research Commission allocated and spent this fund as shown in Table 1.

Attention is called to the two appropriations in the budget that were overdrawn. These overdrafts show that an increase in the budget for these particular projects is absolutely necessary. In the requested budget for the year 1940-1941, provision is made to prevent these overdrafts, and it is hoped that the Budget Committee will not reduce the requested appropriation. The Executive Board tried to run the Research Commission as economically as possible. However, provision must be made to take care of the expanding program and unexpected expense in connection with the work of the Commission.

At the midyear meeting of the Board

TABLE 1.—RESEARCH COMMISSION'S BUDGET AND EXPENDITURES

	Budget	Expenditures		Earnings
Research Fellowship, National Bureau of Standards	$14,500	$14,701.54 ($207.81 overdrawn)		
Bureau of Standards Denture Base Fund		6.27		
Executive Board	500	179.85	$320.15 balance	
Secretary's Office	500	393.01	105.99 balance	
Committee on Research in Dental Caries	1,500	1,715.68	215.68 overdrawn ($3.65 balance)	$798.24
	$17,000	$16,996.35		

of Trustees held in Chicago in February 1940, a midyear report of the Research Commission was presented. This was published in THE JOURNAL for April 1940.

The Executive Board of the Research Commission also held a meeting in February 1940, at which time the affairs of the Commission were transacted. Of special interest to the profession was the hearing in connection with the acrylic resin situation. Manufacturers and distributors were invited to attend this meeting. The three licensed distributors sent representatives. As a result of this hearing, the DuPont Company, shortly after the meeting, notified the Research Commission that it had decided to permit the sale of methyl methacrylate denture material in powder and liquid form by the Company's licensed distributors. A full report of the acrylic resin situation was published in THE JOURNAL for June 1940. The report should be read in conjunction with this report. The Commission believes that a valuable service to the profession has been rendered by its firm stand regarding the acrylic resins. Further information regarding the Commission's position in this matter will be found in that part of this report submitted by the Research Fellowship at the National Bureau of Standards.

REPORT OF THE AMERICAN DENTAL ASSOCIATION RESEARCH FELLOWSHIP AT THE NATIONAL BUREAU OF STANDARDS

INFLUENCE OF THE WORK

The research work on dental materials at the National Bureau of Standards has been very valuable in a number of ways, not the least important of which is the stimulating effect it has had on dental practice, directly and indirectly. As a result of the influence of the work, courses in the science of dental materials have been inaugurated in a number of dental schools; research on and testing of dental materials by dental schools and manufacturing concerns have taken a great spurt, and the practicing dentist has become acutely aware of the need of using satisfactory materials in a correct manner. These effects have been manifested not only in the United States, but in foreign countries as well. The work at the Bureau has promoted work of a similar character in England, Germany, Japan and Australia. In some of these countries, the work has closely followed the lines that the Research Commission and the National Bureau of Standards have followed. An example of this parallelism of ideas is found on pages 127-128 of the April 1939 issue of the *Australian Journal of Dentistry* in an article dealing in part with the need for standards for dental materials. The statement reads: "It is hoped that this laboratory will become a Bureau of Standards for dental materials in Australia." Under a grant from the National Health and Medical Research Council of Australia, pertinent investigations of dental materials are being conducted there.

ACRYLIC RESINS FOR DENTURES

For a time, it appeared that dentistry might be denied the privilege of using methyl methacrylate resins in the powder and liquid form for dentures. The Research Commission, through its research fellowship at the National Bureau of Standards, found that the resin in the powder and liquid form had certain advantages over the resin in the plastic cake form. Consequently, the Commission believed that the resin in the powder and liquid form should not be removed from the market. In order to discuss this matter and to formulate a course of action, a meeting of the Executive Board was held in February, at the time of the Midwinter Meeting of the Chicago Dental Society. Representatives of the distributors who are licensed under the DuPont controlled patents, i.e. the Tidd and Strain patents, were present at this meeting. The Commission is pleased to report that, as a result

of this meeting and by correspondence, it has secured the consent of the DuPont Company to make the trade brands of resins licensed under its patents available in the powder and liquid form. The DuPont Company, in assenting to this procedure, forfeited its patent position in the denture field and probably endangered its legal rights on the Strain patents in other industries. The Commission appreciates the assistance of the company in settling the matter so amicably.

ASSISTANCE TO PROCESS PATENT COMMITTEE

Technical information regarding the methyl methacrylate resins was given to the Process Patent Committee of the Association. At the request of M. D. K. Bremner, chairman of that committee, Daniel F. Lynch and George C. Paffenbarger attended a conference at the DuPont Company offices in Wilmington, Del., to discuss the licensing form which the DuPont Company was offering the profession through the L. D. Caulk Co. Since this matter comes within the jurisdiction of the Process Patent Committee, any details regarding the licensing form or matters pertaining thereto will be given in the report of that committee.

PROSTHETIC BASE METAL ALLOYS

Last year, the International College of Dentists gave $500 to the Research Commission to further any study which the Commission desired to. The Executive Board has tentatively allocated this money, subject to the approval of the Commission, to a special fund to be used in investigating some of the base metal alloys currently used in prosthesis. Such alloys are frequently referred to as stainless chrome alloys and are identified by such trade names as Vitallium and Ticonium.

ASSISTANCE TO THE EDITOR OF THE JOURNAL

At the request of and in cooperation with L. Pierce Anthony, Editor of THE JOURNAL, a plan of editorial supervision was formulated for papers on dental materials that are offered to THE JOURNAL for publication. The method used, which is similar to that adopted by scientific organizations, consists briefly of the following steps:

1. The Editor refers the papers dealing with dental materials to the Research Commission.

2. The secretary sends the paper to from three to five technical readers who are capable of evaluating it. To each reader the following form letter is sent:

Dear Sir:

The enclosed paper, relating to dental materials, has been submitted to THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION for publication. It is the present editorial policy of THE JOURNAL to submit such articles to the Research Commission for review. The Executive Board of the Commission desires to secure the assistance of men who are intimately acquainted with the subject matter of the paper. They value your judgment in these matters and hope you can see fit to read the paper for them.

The Commission's policy in regard to the review of papers will closely simulate the procedure of the American Chemical Society. In your review, please consider the paper especially from the viewpoints of form and technical excellence. Any pertinent comments, and in particular constructive suggestions to the author, are most welcome. Feel free to say what you think, as the comments will be treated anonymously and the author will not know their source. I am sure you will agree that this is a fair method.

The purpose of this arrangement, as you can see, is to insure the publication of worthwhile papers on dental materials in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

Thanking you for your early attention to this matter and for your cooperation, which I am sure you will give, I am

Sincerely yours,

DANIEL F. LYNCH,
Secretary

3. The comments of the readers are

collected and sent to the Editor.

4. The Editor may accept or reject in whole or in part any of the suggestions that the readers for the Commission have made.

LIST OF CERTIFIED MATERIALS

Evidence is accumulating that the List of Certified Dental Materials, which as of March 15, 1940, contained 238 items, is increasingly used by dentists in selecting materials of merit. Reports from many manufacturers state that it is becoming increasingly important to have materials on the "List of Certified Dental Materials," as far as sales are concerned.

Federal purchasing agencies are planning a procedure whereby they may demand that bidders on government contracts for several dental materials show that the items they plan to supply are on the current A. D. A. List of Certified Dental Materials.

TECHNICAL REPORT

We are pleased to enclose the following technical report of the senior Research Associate at the National Bureau of Standards. This report includes work by the Research Associates and the Bureau staff.

OUTLINE OF THE COOPERATIVE DENTAL RESEARCH BETWEEN THE NATIONAL BUREAU OF STANDARDS AND THE AMERICAN DENTAL ASSOCIATION, 1939-1940

The cooperative research on dental materials for the fiscal year 1939-1940 includes (a) the testing of (1) certified materials, (2) denture base materials, (3) base metal alloys for prosthesis and (4) cements; (b) the preparation and revision of specifications, and (c) diverse activities.

Certified Materials.—After a manufacturer certifies to the Research Commission that his products comply with the specifications of the American Dental Association, a sample of the certified material is procured on the open market by the Research Commission and tested by the A. D. A. Research Associates at the National Bureau of Standards for compliance with the specification. The results of this testing during the year are given in Table 2.

TABLE 2.—RESULTS OF TESTS OF MATERIAL FOR 1940

Material	Number of Brands Tested	Number Complying with Specification	Number Failing to Comply with Specification
Amalgam	11	8	3
Wax (inlay)	7	6	1
Impression compound	1	1	
Casting gold alloys (inlay)	9	5	4
Mercury	4	3	1
Wrought gold wire	1		1
Zinc phosphate cement	2	2	
Silicate cement	3	2	1
Total	38	27	11

Denture Base Materials.—Some important physical and chemical properties of the twenty-four denture base materials are being determined.

Representative materials are present, such as rubber, methyl methacrylate, cellulose nitrate, cellulose acetate and mixtures of various types, such as acrylic and vinyl chloride and acetate mixtures, and acrylic and styrene mixtures.

Mechanical properties, as determined by a transverse band test; water absorption; shrinkage during curing or pressing, and change in dimension of dentures when subjected to a wetting and drying cycle are being determined.

Base Metal Alloys.—Preliminary work on methods of determination and some measurements have been made on freezing temperatures, tensile properties, hardness, shrinkage during casting and the physical properties of investments used

with the alloys. Some of the alloys are susceptible to a hardening heat treatment at temperatures at which many gold alloys respond.

Additional work on chemical analysis is in progress.

Cements.—Standard samples of cement for the determination of arsenic content were prepared. The physical properties of various types of cement including zinc oxide-eugenol, black copper, red copper, zinc phosphate, silicate and silicate-zinc phosphate mixtures were determined.

Specifications.—The following specifications were officially approved by the American Dental Association at the Annual Meeting in July 1939:

1. A. D. A. Specification No. 10 for Denture Rubber.

2. A. D. A. Specification No. 11 for Hydrocolloidal Impression Material.

3. Revision of A. D. A. Specification No. 3 for Dental Impression Compound.

The A. D. A. Specification No. 4 for Inlay Casting Wax was revised. The revision will be submitted to the Association for consideration at the September 1940 meeting.

A specification for acrylic resin denture base material is in preparation.

Diverse Activities.—(a) Reports on the program of the Commission and the work of the Fellowship were presented before twelve dental organizations.

(b) Visitors from Finland, England, Brazil, and Bolivia were among the 155 who called at the laboratory during the year.

(c) Publications for the year follow:

1. Research Commission. List of Certified Dental Materials, J.A.D.A., 26: 1197, July 1939.

2. Research Commission. Annual Report. J.A.D.A., 26:1728, October 1939.

3. SWEENEY, W. T.: Denture Base Material: Acrylic Resin. J.A.D.A., 26: 1863, November 1939.

4. PAFFENBARGER, G. C.: Hydrocolloidal Impression Materials: Physical Properties and Specification. J.A.D.A., 27:373, March 1940.

5. Research Commission. List of Certified Inlay Casting Waxes. J.A.D.A., 27:451, March 1940.

6. SWEENEY, W. T., and BEALL, J. R.: American Dental Association Specification No. 3 for Dental Impression Compounds. First Revision—1939. J.A.D.A., 27:713, June 1940.

7. Research Commission. List of Certified Dental Materials. J.A.D.A., 27: 791, June 1940.

8. Research Commission. Acrylic Resins. J.A.D.A., 27:960, June 1940.

Respectfully submitted,

GEORGE C. PAFFENBARGER,
Research Associate.

REPORT OF THE ADVISORY COMMITTEE ON RESEARCH IN DENTAL CARIES*

The book "Dental Caries," published by the Research Commission, had an enthusiastic reception from scientific workers in the field of dental caries research. During the first eight months, the book was distributed from the office of the Secretary of the Research Commission. July 1, 1940, arrangements were made to have the book sold and distributed by the Central Office of the American Dental Association. Up to and including June 30, 1940, 1,360 copies were distributed. Of this number, 541 were complimentary copies distributed throughout the world to the medical and dental journals for review purposes, to leading dental authorities interested in caries research, to all officials of the American Dental Association and to all the contributors. The remaining 819 copies were sold at $1 a copy, making a return to the Association of $798.24. This amount was turned over to Mr. Claridge, the Business Manager of the American Dental Association June 30, 1940. It will

*Daniel F. Lynch, chairman; William J. Gies, secretary; Charles F. Kettering, counselor.

be noted that there is a slight discrepancy between the number sold and the amount of money turned over to the Association. This discrepancy, which amounts to $20.76, is due to unforeseen expenses, such as bank charges, extra foreign postage, telegrams and telephone calls, in connection with distribution of the book. Since turning the distribution of the book over to the Central Office, July 1, 1940, the sale of "Dental Caries" has been progressing steadily but slowly. We have on hand at the present writing about 550 copies. It is believed that the entire first edition will be completely exhausted before the second edition makes its appearance. The first edition is becoming a collector's item and copies of it may in the future be greatly in demand. The first edition should prove a valuable complementary volume to the proposed second edition. The reviewers were unanimous in their praise of the efforts of the Research Commission in making possible the book "Dental Caries." The review published in THE JOURNAL (27:17-18, January 1940) is typical of the many reviews the book received.

Preparations are being made to issue a second edition of "Dental Caries" during the summer of 1941. The second edition will contain summaries of findings and conclusions on the cause and control of dental caries by additional authors. Many authors who contributed to the first edition have since revised their opinions, and these too will be included in the second edition.

Until the second edition is off the press, bound copies of the first edition can be obtained for $1 a copy at the American Dental Association headquarters, 212 East Superior St., Chicago, Ill.

THE PROPOSED FELLOWSHIP IN DENTAL DISEASES AT THE NATIONAL INSTITUTE OF HEALTH, WASHINGTON, D. C.

For the past several years, the Executive Board of the Research Commission has been in communication with the United States Public Health Service regarding the establishment of a fellowship in dental diseases at the National Institute of Health. The chairman and the secretary of the Commission have had several personal interviews with H. Trendley Dean, of the United States Public Health Service, and also with the Surgeon General, Thomas Parran. Both of these men are enthusiastic regarding the establishment of the fellowship. The Commission has been very modest in its request for an initial grant for the establishment of such a fellowship. For the last three years, the Budget Committee has denied the grant, so that further work in establishing the fellowship is made impossible. It is hoped that this year the Board of Trustees will see the necessity of allowing the request of $6,000 for the establishment of such a fellowship.

Fellowships in the National Institute of Health are established by grants of money made outright to the institute. The general field of research may or may not be designated by the grantor, according to his desire. The grant, if conditional (for a specific purpose), must be approved by the National Advisory Health Council before the Surgeon General can recommend it for approval. The manner in which the study is carried on, however, must be left to the chief of the division in which the fellowship is placed, and the right of selection of the personnel and control over the data and publications resulting from the study rest with the National Institute of Health. Of course, the grantor is kept fully informed as to the progress of the work.

The person selected for the fellowship preferably should be a dentist who, in addition to his dental training (D.D.S. or D.M.D.), has had several years of graduate training in pathology, biochemistry, mycology, bacteriology or some

coordinative branch of general science having a direct relationship to the biologic aspects of dental disease. A demonstrated capacity for research of an acceptable nature is naturally a prime requisite. The selection of the particular type of investigative work should be determined at some future date, it to be noted at this time, of course, that the work shall be in the biologic field of dental research.

P. C. LOWERY, *Chairman*
DANIEL F. LYNCH, *Secretary*
Washington, D. C.
July 15, 1940

MIDYEAR REPORT OF THE RESEARCH COMMISSION, 1941

The Executive Board held a three-day meeting in Washington beginning January 12. During that time, it had important conferences with the following men: National Bureau of Standards: Lyman J. Briggs, director; E. W. Bearse, division chief; Wilmer Souder, section chief, and the A. D. A. Fellows.

U. S. Public Health Service: Surgeon General Thomas Parran; Lewis R. Thompson, director, and H. Trendley Dean and co-workers.

Food and Drug Administration: T. G. Klumpp, chief of the drug division, and Alexander C. Murray, administrative official.

A. D. A. Committees: Defense: C. Willard Camalier; Legislative: Sterling V. Mead, and Research Commission: J. L. T. Appleton.

Plans for publishing a second edition of "Dental Caries," probably some time before June 30, 1941, have been formulated, as it is expected that all replies to questionnaires will be in by March 1. This second edition will be similar to the first edition, but will contain more opinions of different authors, especially those from foreign countries. The second edition should be even more valuable than the first.

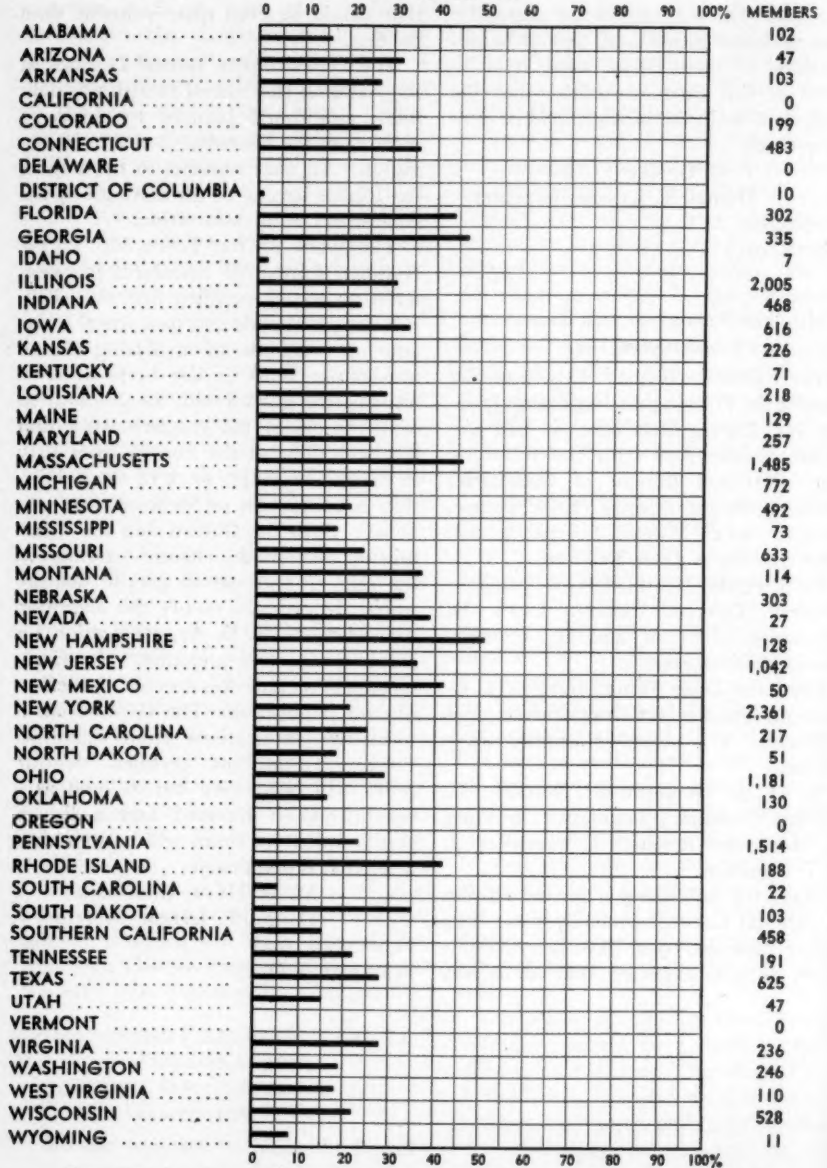
The Fellowship in Dental Diseases at the National Institute of Health was definitely established January 13, during a meeting of the Executive Board in Washington. All that remains to be done is the formal signing of the contract by the American Dental Association.

The work of the Fellowship at the National Bureau of Standards has centered on testing certified materials, denture base materials and base metal alloys and on methods of analyzing dental amalgams. Work is also in progress in assisting the Bureau with the preparation of a résumé of the research work that has been done at the Bureau from 1919 to date. The major work of the Fellowship is at present on denture base materials. Both the Bureau and the Commission realized the chaotic condition in the sale of and use of acrylic denture resins. In order to rectify this condition somewhat, an A. D. A. specification for acrylic resins was prepared. The Commission is making this specification effective on publication. The Commission is receiving certifications from manufacturers. Testing of certified denture resins will be carried out as soon as a certification is received and a list of certified denture resins will be published as soon as is practicable.

M. D. HUFF, *Chairman*
DANIEL F. LYNCH, *Secretary*
February 6, 1941
Washington, D. C.

Membership Page

MEMBERSHIP PERCENTAGE AS OF FEBRUARY 28, 1941



Percentage based on dental population figures supplied by the State Society Secretaries

AMERICAN DENTAL ASSOCIATION MEMBERSHIP

JUNIOR MEMBERS

1940

Atlanta Southern Dental College	45
Baylor University	63
Chicago College of Dental Surgery	126
College of Physicians and Surgeons	107
Columbia University	155
Creighton University	14
Georgetown University	127
Harvard University	9
Indiana University	45
Kansas City-Western Dental College	74
Loyola University	85
Marquette University	129
Medical College of Virginia	40
New York University	25
North Pacific College of Oregon	114
Northwestern University	24
Ohio State University	83
St. Louis University	25
State University of Iowa	14
Temple University	55
Texas Dental College	52
Tufts College	1
University of Buffalo	19
University of California	5
University of Detroit	45
University of Illinois	13
University of Louisville	5
University of Maryland	69
University of Michigan	40
University of Minnesota	18
University of Nebraska	8
University of Pennsylvania	22
University of Pittsburgh	43
University of Southern California	134
University of Tennessee	4
Washington University	31
Western Reserve University	97
Total Junior Members	1,965

MEMBERSHIP RECAPITULATION

February 28, 1941

Regular Members	19,787
Junior Members	1,965
Affiliate Members	148
Total—All Members	21,900

LECTURES ON MILITARY DENTISTRY

APPROVAL of the publication of the "Lectures on Military Dentistry" was granted by the Board of Trustees of the American Dental Association during the midwinter meeting of the Board.

The manual is to be devoted to the adaptation of dental science and art to the injuries of the face and jaws which accompany a defense training program and actual warfare. It will consist of several chapters written by men in the Dental Corps of the United States Army; will be completely illustrated and will serve as an excellent guide for organized study groups.

The publication is now in galley form and will be ready for distribution in the very near future. It will be sold at a nominal charge to defray the costs of printing and distribution. All orders for it should be directed to the Committee on Dental Preparedness, American Dental Association, 212 East Superior St., Chicago, Ill.

CURRENT LITERATURE

Relationship Between Two Kinds of Measurements of Dental Caries

By HENRY C. SANDLER

THE two most frequently used methods for the measurement of dental caries are the Bodecker index and the DMF. The former is based upon the assumption that each of the five surfaces of each tooth offers a risk to caries and that each surface is a unit. The index is the ratio between the areas affected by caries and the total number of areas that could possibly be affected by caries. The latter expresses the number of decayed, missing or filled teeth. Both represent a measure of the total caries experience of the individual. A group of 167 children were selected between the ages of 5 and 7 years for this study. In a careful examination of this group, both methods of notation were used. It was found that there was a high degree of correlation between the two methods. The Bodecker index could be predicted from the known DMF within reasonable limits. It was suggested that, in dental examinations of a large number of individuals, the DMF method is adequate, and available dental funds could be more efficiently and effectively expended by the use of this method.—*J. D. Res.*, 19:545, December 1940.

JAMES T. GINN.

Dicalcium Phosphate and Cod Liver Oil as Factors in Prevention of Dentin Hypocalcia Resulting from Artificially Induced Fever

By PAUL C. KITCHIN and MILTON BERMAN

SEVERAL litters of young rats were subjected to artificially induced fever. Some of these rats were given dicalcium phosphate and cod liver oil in addition to the regular diet. The high temperatures caused a disturbance in the normal formation of dentin. Interglobular dentin was laid down in those rats that were on the regular diet, while those on the supplemented diet seemed to resist the effects of the high temperature on dentin formation. The rats on the supplemented diet suffered less from alopecia and, after the fever was over, regained the lost weight quicker.

The enamel was not affected in either group, possibly owing to the lack of toxins present in the infectious eruptive diseases. It is important to note that the administration of dicalcium phosphate and cod liver oil aids greatly in the formation of normal dentin during fever.—*J. D. Res.*, 19:505, December 1940.

E. C. WOODS.

Correlation of Periodontal Disease and Caries

By SAMUEL C. MILLER and BENJAMIN B. SEIDLER

THE antagonism between periodontal disease and dental caries has been the subject of much discussion, and no definite conclusions have been reached in regard to this controversy. This study was made in an attempt to determine mathematically whether any significant correlation, positive or negative, exists between the two conditions. A group of 1,003 cases were studied roentgenographically. The Bodecker modified dental caries index was used in expressing the caries experience in the group. Alveoloclasia rather than a simple gingivitis was used as the index of periodontal disease. It was suggested that there seemed to be an antagonism between the two conditions based on sex. Males were more susceptible to periodontal disease and females were more susceptible to dental caries. The authors conclude that there is no relation between periodontal disease and dental caries.—*J. D. Res.*, 19:549, December 1940.

JAMES T. GINN.

Saliva and Enamel Decalcification. V. Clinical Interpretation

By J. T. GORE

THIS study considers the physical and chemical factors in various clinical forms of enamel decalcification. Toothbrush abrasion and attrition produced in extracted teeth resembled the clinical form of these conditions. It is believed that the theoretical pH at which no decalcification of the enamel takes place is approximately 7.7 As saliva rarely reaches that degree of alkalinity, it is possible that some superficial decalcifica-

tion of the cementing substance is slowly occurring. Some remineralization may take place, but the involved area has been rendered less resistant to mechanical abrasion. It is suggested that the type, degree and rapidity of enamel decalcification depend on the structure and chemical composition of the enamel, the concentration of the sodium bicarbonate in saliva and the ratio of potential calcium and phosphate-ion concentration to the potential hydrogen-ion concentrated in the precipitated mucin. The author summarizes his findings as follows: "The various clinical forms of enamel decalcification, including pit and fissures, approximal and gingival, mechanical abrasion (brush or attrition), erosion, cracks, increasing friability, penetrating stains and senile caries, are probably the result of the chemical composition of the saliva and the chemical and physical changes which take place in the stagnant saliva."—*J. D. Res.,* 19:563, December 1940.

JAMES T. GINN.

Calcium and Phosphorus in Relation to Oral Pathology

By WILLIAM A. MUSGROVE

A GROUP of biochemical tests have been worked out to determine the acid-base balance and the calcium, phosphorus, potassium and chlorine balance of the saliva and urine. Reactions that can be used as a guide in diet regulation have been determined by testing hundreds of immune individuals to reach the normal or optimum reaction of the specimen.

The author brings out the importance of the usual methods of scaling, brushing, medication and surgical procedure in addition to dietary methods in treatment of pyorrhea alveolaris. The disease is divided into three classes from a chemical standpoint: (1) low calcium and very high phosphorus, (2) low calcium and low phorphorus and (3) high calcium and low phosphorus. The effect of certain foods on the chemical contents of saliva and urine specimens is tabulated and the factors listed on which the calcium and phosphorus levels are dependent. Consideration is given the relationship of pyorrhea to such conditions as general lowered resistance, insanitary living conditions, poor diet, nervous breakdown and degenerative processes going on in nervous membranes and alveolar processes.

Correction of an abnormal chemical content of the saliva may be taken care of by dietary measures. Diet and classified food lists are given, as well as biochemical tests for pH, calcium, phosphorus, chlorine and potassium.—*Mil. Surgeon,* 88:169, February 1941.

JAMES STRIEGEL.

A Survey of Nutrition and Dental Caries in 120 London Elementary School Children

By JUNE ALLEN

THREE examinations were made during one year and the findings recorded in the study. Since the nutrition of an individual may vary from time to time, it is difficult to relate it to any other condition at any given time. Good dental structure is reported to have been produced in animals by dietary procedures, and this may be possible in children also. Good structure, making the teeth resistant to caries, is the first line of defense. Posteruptive changes appear to provide some form of secondary protection.

In the 120 school children examined for dental caries and surface structure defects of the teeth, it was found that the lower incisors and cuspids showed the best structure and the molars the worst, the soundest being those formed mostly *in utero.* There is a definite relationship between structural quality and the amount of caries present in the teeth. The better the structure, the more resistant the teeth. Improvement in the general physical condition seems to be associated with a decrease in the incidence of dental caries.—*Brit. M. J.,* 44: January 11, 1941.

JAMES STRIEGEL.

On the Manner of Acquisition of Fluorine by Mature Teeth

By MABEL W. PERRY and W. D. ARMSTRONG

MALE albino rats that had been raised to maturity on the same stock diet were given a measured diet and water intake over a sixty-day period, the water supplied to the experimental group containing 20 parts per million of fluorine. After five days on only distilled water, the animals were killed and the teeth obtained for the study. The molars and incisors were pooled in sep-

arate lots and the enamel and dentin removed for analysis. The molars were found to contain more fluorine in the dentin than in the enamel, but the reverse was true with respect to the incisor teeth. Furthermore, when the animals were given water containing 20 parts per million of fluorine, it was found that the fluorine content of the dentin of molar teeth of mature rats was not increased. From these facts, it is concluded that a secondary enrichment of dentin with fluorine occurs after its calcification, and that the process does not continue indefinitely. The fluorine content of the enamel of mature erupted rat molars is increased by the fluorine entering the surface when the animals are given drinking water containing 20 parts per million of the element.—*J. Nutrition*, 21:35, January 1941.

JAMES STRIEGEL.

Histopathologic Studies of Abnormal Enamel Formation in Human Teeth

By SEYMOUR J. KRESHOVER

ATTEMPTS have been made in the literature to associate abnormal enamel formation with various organic and functional disturbances such as syphilis, dietary deficiencies and fluorosis. In this connection, Hutchinson first described a peculiar type of hypoplasia as indicative of congenital syphilis. The author has made histologic studies of developing teeth in eleven infants and human fetuses. Of these cases, five were characterized by abnormal enamel development, the other six being normal and considered as controls. There were three stages in or degrees of severity of the abnormality observed. The least severe was that marked by abnormal secretion of enamel substance with little or no change in the ameloblast. This was described as probably a reversible process or indicative of a resultant incremental line. The next stage was marked by complete cystic destruction, resulting in a true clinical hypoplasia.

By virtue of the wide variety of gross pathologic entities found in the cases studied and the fact that the developing teeth histologically exhibited the same phenomena in all cases studied, the conclusion is drawn that abnormal enamel formation is of a non specific nature and cannot be definitely associated with any particular disease process or injury. Hypoplastic amelogenesis may result from a variety of disturbances, the degree depending on the severity of the causative agent and the amount of tissue response.—*Am. J. Orthodontics*, 26:1083, November 1940.

ALDEN H. POORMAN.

Teratoma (Mixed Tumor) of the Right Parotid Gland with Metastasis to Sternum and Second Rib Left

By S. K. LIVINGSTON

BECAUSE of the relative infrequency of skeletal metastasis in teratoma of the parotid gland, this case was reported. The patient was a colored man, aged 44, who was admitted March 18, 1937, with a recurrent swelling of the right jaw following removal of a right parotid tumor nine years previously. He was cachetic and chronically ill when admitted. The present condition was of three years' standing. Roentgen therapy had been administered in 1935 and roentgenograms of the thoracic framework revealed no metastasis at the time. In 1937, metastasis were evident upon examination. Radium therapy was administered in April 1937, but death occurred on May 29. A postmortem examination revealed metastasis to the lungs, liver, spleen, left suprarenal gland, gallbladder, sternum and left second rib.—*Am. J. Roentgenol.*, 44:887, December 1940.

VIRGIL D. CHEYNE.

Prevention of Human Bite Infections

By RICHARD E. SPEIRS

THE serious complications following human bites, especially those of the hands, have long been recognized as due to infection by organisms of the mouth. Once infection has resulted from such conditions, the treatment is very difficult and is likely to result in loss of tissue and function. The author made a study of 114 cases of human bite given prophylactic treatment within the first few hours after the injury. This treatment consisted of carefully washing the area with soap and water, after which the wound was gently but thoroughly sponged with soap and water for ten minutes. The treatment prevented infection in eighty-two cases. In thirty-five cases which were followed to complete healing, the average time required was seven and eighth-tenths days. Three of the fourteen cases treated by

cauterization with phenol and alcohol gave evidence of inflammation, but the wound did not suppurate. In two cases of human bite of the hand in which primary closure of the wound was carried out in addition to cleaning with soap and water, the wound became infected and hospitalization was required.

The author suggests that early and careful washing of human bites with soap and water is preferable to other forms of immediate treatment whether chemical, electrocautery or surgical incision.—*Surg. Gynec. & Obst.*, 72:437-452, February 1941.

J. T. GINN.

Treatment of Tumours of the Parotid Gland, with Special Reference to Total Parotidectomy

By HAMILTON BAILEY

ALL potentially malignant tumors should be curable. Mixed parotid tumors that become malignant are malignant locally for a few months before they metastasize. All tumors in this category are curable, but the fear that the facial nerve may be cut and a salivary fistula develop seems to discourage surgical interference.

The author has a few modifications in the care of these tumors that he would like to see adopted. He states that:

1. Nearly all tumors of the parotid gland are radioresistant, and deep x-ray therapy is of no avail. 2. The capsule of encapsulated tumors must be removed. Before the capsule is opened and after the tumor is removed, the area should be flooded with 60 per cent alcohol. 3. Adequate exposure should be employed. The Blair incision is recommended. 4. Salivary fistula following the removal of these tumors is extremely rare. 5. The surgical anatomy of the parotid gland might well be revised. 6. Even when facial palsy occurs, the deformity can be mitigated.

Six cases are reported and a detailed description of the operative technic of total parotidectomy is given.—*Brit. J. Surg.*, 28: 111, January 1941.

E. C. WOODS.

Effect of the Blackout on Tooth Development During the Exanthematous Fevers

By JAMES AITCHISON

THE exanthematous fevers appear to harm the teeth by damaging the functional activity of the ameloblasts. Coincidentally with this fact, adequate supplies of calcium, phosphorus and vitamin D must be supplied in order that the ameloblasts be not permanently injured. Death of the enamel-forming cells will result in a dearth of functioning ameloblasts, a thin coating of enamel of poor quality resulting.

To prevent these effects, patients should be assured of sufficient vitamin D, either through diet or through exposure to sunlight. In addition, the normal protein balance in the diet should be restored as soon as possible after chemotherapy.—*D. J. Australia*, 13:85, February 1941.

A. PEARSON.

A Prosthetic Ulcer of the Mouth

By H. T. SIMMONS

A BENIGN type of oral tumor not described in current textbooks and literature is presented as an entity occurring in the middle aged, usually as a result of several years' wear of a prosthetic appliance. Clinically, it consists of two or more ridges between which are furrows of inflamed and ulcerated mucous membrane. It is located in the mucous fold between the lips or cheek and the alveolar ridge. On palpation, the tumor is hard, and, when irritated, it may easily be mistaken for a malignant growth. The best treatment is excision by diathermy, and rebuilding of the faulty denture.—*Brit. M. J.*, 1:119, January 25, 1941.

H. B. MCCAULEY.

Cheilitis from Sensitivity to Oil of Cinnamon Present in Bubble Gum

By JEROME MILLER

AN interesting case is presented of hypersensitivity to oil of cinnamon, not from contact with the oil itself, but with its fumes, the symptoms being swelling and mild erythema about the lips, which were swollen, rough, fissured and scaly, with an itching and a burning sensation. Hypersensitivity to the fumes of oil of cinnamon with which the patient came in contact during the course of her work was demonstrated by the patch and fume test. Amelioration of symptoms followed avoidance of the oil.—*J.A.M.A.*, 116:131, January 11, 1940.

N. SIMMONS.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

AKRON (OHIO) DENTAL SOCIETY, April 14 and May 14.

AMERICAN ASSOCIATION OF ORTHODONTISTS, New York, N. Y., May 5-8.

AMERICAN BOARD OF ORTHODONTICS, New York, N. Y., May 3.

AMERICAN DENTAL ASSISTANTS ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN DENTAL ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN PUBLIC HEALTH ASSOCIATION, Atlantic City, N. J., October 14-17.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY, INC., New York, N. Y., March 24.

CHICAGO COLLEGE OF DENTAL SURGERY ALUMNI ASSOCIATION, April 7-8.

CLEVELAND DENTAL SOCIETY, Cleveland, Ohio, May 5-7.

DALLAS MIDWINTER DENTAL CLINIC, Dallas, Texas, April 21-23.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

MEXICAN ORTHODONTISTS ASSOCIATION, Mexico City, June 23-28.

NATIONAL BOARD OF DENTAL EXAMINERS, May 5-6.

NATIONAL DENTAL ASSOCIATION, Richmond, Va., August 11-15.

NEW YORK UNIVERSITY COLLEGE OF DENTISTRY CLASS OF 1921, New York, N. Y., May 22.

ONTARIO DENTAL ASSOCIATION, Toronto, May 19-21.

PHILADELPHIA DENTAL COLLEGE ALUMNI SOCIETY, Philadelphia, Pa., May 21-22.

SIGMA EPSILON DELTA FRATERNITY CONVENTION, New York, N. Y., April 5-6.

SOUTHERN SOCIETY OF ORTHODONTISTS, Raleigh, N. C., September 29-30.

WASHINGTON UNIVERSITY SCHOOL OF DENTISTRY SEVENTY-FIFTH ANNIVERSARY, St. Louis, Mo., April 7-12.

WESTERN RESERVE DENTAL ALUMNI ASSOCIATION, Cleveland, Ohio, June 9.

STATE SOCIETIES

April

Alabama, at Birmingham (8-10)
California, at San Francisco (21-23)
Connecticut, at Bridgeport (30-May 2)
Kansas, at Topeka (27-30)
Kentucky, at Louisville (7-9)
Massachusetts, at Boston (14-17)
Michigan, at Detroit (21-23)
Oklahoma, at Oklahoma City (27-30)
Panama, at Panama City
Texas, at Dallas (20)

May

Arkansas, at Fort Smith (19-21)
Georgia, at Savannah (19-21)
Illinois, at Peoria (12-15)
Indiana, at Indianapolis (19-21)
Iowa, at Des Moines (5-7)
Louisiana, at New Orleans (1-3)
Maryland, at Baltimore (5-6)
Missouri, at St. Joseph (4-7)
Montana, at Missoula (1-3)
Nebraska, at Omaha (12-14)
New Jersey, at Asbury Park (7-9)
New York, at Buffalo (12-16)
North Carolina, at Pinehurst (12-14)
North Dakota, at Fargo (12-14)
South Carolina, at Columbia (5-6)
Tennessee, at Knoxville (12-15)
Virginia, at Old Point Comfort (8-10)
West Virginia, at White Sulphur Springs (19-21)

June

Colorado, at Colorado Springs (19-21)
Idaho, at Sun Valley
Maine, at Portland (26-28)
Mississippi, at Biloxi (9-11)

Nevada, at Reno (7)
New Hampshire, at New London (22-24)
New Mexico, at Albuquerque
Pennsylvania, at Bedford (3-5)
South Dakota, at Rapid City (15-17)
Utah, at Salt Lake City (26-28)
Wyoming, at Cody

July

Washington, at Portland

September

Southern California, at Los Angeles (8-10)
Hawaii, at Honolulu

November

Ohio, at Columbus

STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 23. W. A. Wood, Merchants Nat'l Bank Bldg., Mobile, Secretary.

California, at San Francisco, May 19, and at Los Angeles, June 16. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

Connecticut, at Hartford, June 24-28. Clarence G. Brooks, New London, Recorder.

Delaware, at Wilmington, June 17-20. Charles R. Jefferis, Medical Arts Bldg., Wilmington, Secretary.

Florida, at Jacksonville, June 23-27. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Georgia, at Atlanta, June 9-12. R. C. Coleman, Room 11, State Capitol, Atlanta, Secretary.

Indiana, at Indianapolis, June 3-7. D. Gordon Lamb, 819 Chamber of Commerce Bldg., Indianapolis, Secretary.

Kentucky, at Louisville, June 10-13. Leon M. Childers, 1312 First Nat'l Bank Bldg., Lexington, Secretary.

Maine, at Augusta, June 23-25. Carl W. Maxfield, 31 Central St., Bangor, Secretary.

Mississippi, at Jackson, June 17. G. L. Clement, Pontotoc, Secretary.

Nebraska, at Omaha and Lincoln, June 16-21. Henry A. Merchant, Medical Arts Bldg., Omaha, Secretary.

New Jersey, June 23-28. W. A. Wilson, 148 W. State St., Trenton, Secretary.

North Carolina, at Raleigh, June 23. Wilbert Jackson, Rich Bldg., Clinton, Secretary.

North Dakota, at Fargo, July 7-10. L. I. Gilbert, 401 Black Bldg., Fargo, Secretary.

Ohio, at Columbus, June 23. Morton H. Jones, 1553½ N. Fourth St., Columbus, Secretary.

Oklahoma, at Oklahoma City, June 16-19. W. T. Longwell, 1st National Bank Bldg., Frederick, Secretary.

Oregon, at Portland, June 9-13. Arthur F. Weeks, Selling Bldg., Portland, Secretary.

Pennsylvania, at Philadelphia and Pittsburgh, June 17-21. Reuben E. V. Miller, 61 N. Third St., Easton, Secretary.

South Dakota, at Rapid City, June 18-21. C. H. Boyden, Mitchell, Secretary.

Texas, at Dallas, June 16-20. B. Carl Holden, Nixon Bldg., Corpus Christi, Secretary.

Vermont, at Montpelier, June 23-25. C. I. Taggart, Burlington, Secretary.

West Virginia, at Charleston, June 23. Henry C. Hill, Charleston, Secretary.

Wisconsin, at Milwaukee, June 16-20. S. F. Donovan, Tomah, Secretary.

AKRON DENTAL SOCIETY

THE Akron (Ohio) Dental Society will meet at the Mayflower Hotel April 14, at 6:30 p.m.; J. R. Cameron, Philadelphia, essayist; subject, "Exodontia as Related to the General Practitioner." May 14, an all-day clinic will be held at the Mayflower Hotel, starting at 9 a.m.; essayist, W. T. McFall, Asheville, N. C.

A. A. GERMAN, *Secretary,*
180 Exchange St.

AMERICAN ASSOCIATION OF ORTHODONTISTS

THE thirty-ninth meeting of the American Association of Orthodontists will be held at the Waldorf Astoria Hotel in New York, N. Y., May 5-8.

MAX E. ERNST, *Secretary,*
1250 Lowry Medical Arts Bldg.,
St. Paul, Minn.

AMERICAN BOARD OF ORTHODONTICS

A MEETING of the American Board of Orthodontics will be held at the Waldorf-Astoria Hotel, New York, N. Y., May 3. Orthodontists who desire to obtain certificates of qualification from the board should secure application blanks from the secretary. Applications must be in at least sixty days

before the meeting. For further information, address

CHARLES R. BAKER, *Secretary,*
636 Church St.,
Evanston, Ill.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

THE seventeenth annual session of the American Dental Assistants Association will be held in Houston, Texas, October 27-31. For further information, address

AILEEN M. FERGUSON,
General Secretary,
709 Centre St.,
Jamaica Plain, Mass.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

THE eighteenth annual meeting of the American Dental Hygienists' Association will be held in Houston, Texas, October 27-31.

A. REBEKAH FISK, *Secretary,*
General Dispensary, U. S. Army,
Washington, D. C.

AMERICAN PUBLIC HEALTH ASSOCIATION

THE seventieth annual meeting of the American Public Health Association will be held in Atlantic City, N. J., October 14-17. Headquarters, Convention Hall; residence headquarters, Hotel Traymore.

WILLIMINA RAYNE WALSH,
Associate Secretary,
1790 Broadway,
New York, N. Y.

ALUMNI ASSOCIATION, CHICAGO COLLEGE OF DENTAL SURGERY

THE Fifty-Eighth Annual Homecoming Clinic of the Chicago College of Dental Surgery, Dental School of Loyola University, will be held April 7-8 at the college.

GUY M. SMITH, *President.*

CLEVELAND DENTAL SOCIETY

THE Spring Clinic Meeting of the Cleveland Dental Society will be held May 5-7 at the Statler Hotel, Cleveland.

IRWIN F. STEUER, *Chairman,*
Publicity Committee,
308 Republic Bldg.,
Cleveland, Ohio.

DALLAS MIDWINTER DENTAL CLINIC

THE fourteenth annual meeting of the Dallas Midwinter Dental Clinic will be held in Dallas, Texas, at the Hotel Adolphus, April 21-23, immediately after an all-day session of the House of Delegates of the Texas State Dental Society, April 20. A three-day study course will be given by Fred C. Meyers, Minneapolis, Minn., on "Restorative Dentistry"; W. Clyde Davis, Lincoln, Nebr., on "Synthetic Porcelain"; George W. Christiansen, Detroit, Mich., on "Oral Surgery," and O. M. Dresen, Milwaukee, Wis., on "Prosthetic Dentistry." April 22, the members of the Dallas County Dental Society will present table clinics, after the banquet. The fee for the full three-day course is $15, including a ticket to the banquet. All members of the American Dental Association are invited. Presentation of a 1941 membership card is requested on registration.

PHELPS J. MURPHEY, *Chairman,*
Publicity Committee,
Fairmount and Welborn Sts.,
Dallas.

MEXICAN ORTHODONTISTS ASSOCIATION

THE Third Medicodental Convention of the Mexican Orthodontists Association will be held in Mexico City, June 23-28, at the School of Dentistry of the National University of Mexico. Members of the American Dental Association are welcome.

S. FASTLICHT, *Secretary,*
Madero 40,
Mexico City.

NATIONAL BOARD OF DENTAL EXAMINERS

THE National Board of Dental Examiners will hold its next session for the examination of candidates in Parts I and II, May 5-6, in schools where there are five or more candidates. For further information and application blanks, address

MORTON J. LOEB, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

NATIONAL DENTAL ASSOCIATION

THE National Dental Association will convene for the twenty-eighth annual session August 11-15, in Richmond, Va. For further information, address

J. A. JACKSON, *Secretary,*
Charlottesville, Va.

NEW YORK UNIVERSITY COLLEGE OF DENTISTRY CLASS OF 1921

THE twentieth reunion of the Class of 1921 of the New York University College of Dentistry will be held May 22 at 7 p.m. at the Hotel Pennsylvania, New York. For reservations, call or write

JEROME H. TRIER,
993 Park Ave.,
New York.

ONTARIO DENTAL ASSOCIATION

THE Seventy-Fourth Annual Convention of the Ontario Dental Association will be held at the Royal York Hotel, Toronto, Ontario, May 19-21. Dentists from the United States and from all parts of Canada will be welcome.

FRED J. CONBOY, *Secretary,*
86 Bloor St., West,
Toronto.

ALUMNI SOCIETY OF THE PHILADELPHIA DENTAL COLLEGE

THE seventy-eighth annual session of the Alumni Society of the Philadelphia Dental College (Temple University School of Dentistry) will be held May 21-22, with scientific sessions, forum, clinics and the annual reunion banquet and dance.

DAVID K. WALDMAN, *Editor.*

SIGMA EPSILON DELTA FRATERNITY CONVENTION

THE Sigma Epsilon Delta Fraternity will celebrate its fortieth anniversary April 5-6 at the Hotel Pennsylvania, New York, N. Y. For further information, address

DAN KOLLEN,
24 W. 59th St.,
New York, N. Y.

SOUTHERN SOCIETY OF ORTHODONTISTS

THE next meeting of the Southern Society of Orthodontists will be held in Raleigh, N. C., September 29-30.

T. C. SPARKS, *Secretary,*
Medical Arts Bldg.,
Columbia, S. C.

WASHINGTON UNIVERSITY SCHOOL OF DENTISTRY SEVENTY-FIFTH ANNIVERSARY

WASHINGTON UNIVERSITY SCHOOL OF DENTISTRY, St. Louis, Mo., will celebrate its seventy-fifth anniversary April 7-12, under the sponsorship of the dental alumni association. The week will be devoted to lectures and refresher courses. The profession is invited to participate. For further information, address the Seventy-Fifth Anniversary Committee, 4952 Maryland Ave., St. Louis, Mo.

WESTERN RESERVE DENTAL ALUMNI ASSOCIATION

THE Western Reserve Dental Alumni Association announces its annual Alumni Day at the School of Dentistry, June 9, with dinner and class reunion at the Mid Day Club, 6:30 p.m.

JOSEPH R. GOULD,
630 Rose Bldg.,
Cleveland, Ohio.

ALABAMA DENTAL ASSOCIATION

THE seventy-second session of the Alabama Dental Association will be held at the Tutwiler Hotel, Birmingham, April 8-10, celebrating the centennial of the world's first dental law, which was enacted in Alabama in 1841.

GEORGE W. MATTHEWS, *Secretary,*
905 Protective Life Bldg.,
Birmingham.

SOUTHERN CALIFORNIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Southern California State Dental Association will be held September 8-10 at the Los Angeles Biltmore Hotel.

FRANCIS J. CONLEY, *Secretary,*
804 Professional Bldg.,
Los Angeles.

GEORGIA DENTAL ASSOCIATION

THE seventy-third annual meeting of the Georgia Dental Association will be held at Savannah, May 19-21, with headquarters at the Hotel DeSoto.

R. H. MURPHY, *Secretary,*
Macon.

ILLINOIS STATE DENTAL SOCIETY

THE next annual meeting of the Illinois State Dental Society will be held in Peoria, May 12-15.

L. H. JACOB, *Secretary,*
Jefferson Building,
Peoria.

KANSAS STATE DENTAL ASSOCIATION

THE seventieth annual session of the Kan-

sas State Dental Association will be held in the Municipal Auditorium, Topeka, April 27-30.

FRED A. RICHMOND, *Secretary,*
Huron Building,
Kansas City.

KENTUCKY STATE DENTAL ASSOCIATION

THE eighty-first annual meeting of the Kentucky State Dental Association will be held at the Brown Hotel, Louisville, April 7-9.

J. L. WALKER, *Secretary,*
640 Barbee Way South,
Louisville.

LOUISIANA STATE DENTAL SOCIETY

THE sixty-first annual meeting of the Louisiana State Dental Society will be held May 1-3, at the Roosevelt Hotel, New Orleans.

JULIAN S. BERNHARD, *Secretary,*
417 Medical Arts Bldg.,
Shreveport.

MASSACHUSETTS DENTAL SOCIETY

THE Massachusetts Dental Society will meet April 14-17.

PHILIP E. ADAMS,
106 Marlboro St.,
Boston.

MICHIGAN STATE DENTAL SOCIETY

THE eighty-fifth annual meeting of the Michigan State Dental Society will be held in Detroit, April 21-23.

WILLIAM R. DAVIS, *Secretary,*
Michigan Dept. of Health,
Lansing.

MISSOURI STATE DENTAL ASSOCIATION

THE Missouri State Dental Association will hold its next meeting in St. Joseph, May 4-7.

C. W. DIGGS, *Secretary,*
Exchange National Bank Bldg.,
Columbia.

MONTANA STATE DENTAL ASSOCIATION

THE thirty-eighth annual session of the Montana State Dental Association will be held in Missoula, May 1-3.

T. T. RIDER, *Secretary,*
9 Higgins Block,
Missoula.

NEW HAMPSHIRE DENTAL SOCIETY

THE next meeting of the New Hampshire Dental Society will be held June 22-24, at Soo-Nipi Park Lodge, New London.

FLOYD E. WILLIAMS, *Secretary,*
814 Elm St.,
Manchester.

NEW JERSEY STATE DENTAL SOCIETY

THE next annual meeting of the New Jersey State Dental Society will be held in Asbury Park, May 7-9, at the Berkeley Carteret Hotel.

F. K. HEAZELTON, *Secretary,*
223 E. Hanover St.,
Trenton.

DENTAL SOCIETY OF THE STATE OF NEW YORK

THE Dental Society of the State of New York will convene in Buffalo for its seventy-third annual meeting, May 12-16, at the Statler Hotel. Members of the American Dental Association and the Canadian Dental Association are invited.

LEON J. GAUCHAT, *Chairman,*
Press and Publications,
333 Linwood Ave.,
Buffalo.

PENNSYLVANIA STATE DENTAL SOCIETY

THE seventy-third annual meeting of the Pennsylvania State Dental Society will be held at the Bedford Springs Hotel, Bedford, June 3-5.

C. J. HOLLISTER,
Executive Secretary,
217 State St.,
Harrisburg.

OKLAHOMA STATE DENTAL SOCIETY

THE next meeting of the Oklahoma State Dental Society will be held in Oklahoma City, April 27-30.

O. W. BOYER, *Secretary,*
Perry.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

THE seventy-first annual meeting of the South Carolina State Dental Association will be held in Columbia, May 5-6, with headquarters at the Wade Hampton Hotel.

P. B. HAIR, *Secretary,*
Spartanburg.

SOUTH DAKOTA STATE DENTAL SOCIETY

THE fifty-ninth annual session of the South Dakota Dental Society will be held at Rapid City in the Black Hills, June 15-17.

ERNEST W. ELMEN, *Secretary,*
Sioux Falls.

TENNESSEE STATE DENTAL ASSOCIATION

THE seventy-fourth annual meeting of the Tennessee State Dental Association will be held at the Hotel Andrew Johnson, Knoxville, May 12-15.

HOWARD M. TAYLOR, *Secretary,*
206 Medical Arts Bldg.,
Knoxville.

VIRGINIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Virginia State Dental Association will be held at the Chamberlain Hotel, Old Point Comfort, May 8-10.

J. E. JOHN, *Secretary,*
Medical Arts Bldg.,
Roanoke.

BOARD OF DENTAL EXAMINERS OF ALABAMA

THE Board of Dental Examiners of Alabama will conduct its next annual dental examination beginning June 23, in Birmingham. All credentials must be filed with the secretary at least two weeks in advance of the examination. Address all correspondence to

W. A. WOOD, *Secretary,*
Merchants Nat'l Bank Bldg.,
Mobile.

STATE OF CALIFORNIA BOARD OF DENTAL EXAMINERS

THE next examinations of the Board of Dental Examiners of California for license to practice dentistry and for license to practice dental hygiene in the State of California will be held in San Francisco, commencing May 19, at the Physicians & Surgeons College of Dentistry, 344 Fourteenth St., and the University of California, College of Dentistry, Third and Parnassus Ave. There will also be an examination in Los Angeles in Room 804, City Hall, and the University of Southern California, College of Dentistry, 122 E. Sixteenth St., commencing June 16. All credentials must be in the office of the secretary, Room 203, 515 Van Ness Ave., San Francisco, at least twenty days prior to the date of any examination. Address all communications to Kenneth I. Nesbitt, Secretary.

CONNECTICUT DENTAL COMMISSION

THE Connecticut Dental Commission will meet in Hartford, June 24-28, for the examination of applicants for license to practice dentistry and dental hygiene and to transact any other business proper to come before it. Applications must be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to

CLARENCE G. BROOKS, *Recorder,*
New London.

DELAWARE STATE BOARD OF DENTAL EXAMINERS

THE examination of dental and oral hygienist candidates will be held at the Delaware Hospital, Wilmington, June 17-20.

CHARLES R. JEFFERIS, *Secretary,*
Medical Arts Bldg.,
Wilmington.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

THE Florida State Board of Dental Examiners will hold its annual examination of applicants for license to practice dentistry and dental hygiene in Florida at Jacksonville in the Seminole Hotel, June 23-27. Preliminary applications must be filed by April 23. Final application for examinations in dentistry and in dental hygiene must be complete by May 23. Address all communications to

H. B. PATTISHALL, *Secretary,*
351 St. James Bldg.,
Jacksonville.

BOARD OF DENTAL EXAMINERS OF GEORGIA

THE Georgia Board of Dental Examiners will meet June 9-12 at the State Capitol. For application blanks, address

R. C. COLEMAN, *Joint Secretary,*
Room 111, State Capitol,
Atlanta.

INDIANA STATE BOARD OF DENTAL EXAMINERS

THE next examination for licensure of the Indiana State Board of Dental Examiners

will be held in Indianapolis beginning June 3 and continuing four days. All applications, fees and credentials positively must be in the hands of the secretary not later than ten days prior to the beginning date of the examinations. For applications, instructions and other information, address

D. GORDON LAMB, *Secretary,*
819 Chamber of Commerce Bldg.,
Indianapolis.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Kentucky State Board of Dental Examiners will be held June 10-13, 1941 at the University of Louisville, Dental School, Louisville. Dentists having graduated prior to 1941 and desiring to stand examination before this board must have filed applications, complete with full information requested, at this office not later than April 10. Applications of 1941 graduates must be in our file by May 30. Ample time should be allowed for securing all data required. For application forms and further information, apply to

LEON M. CHILDERS, *Secretary,*
1312 First Nat'l Bank Bldg.,
Lexington.

MAINE STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Maine State Board of Dental Examiners will be held June 23-25 at the State House, Augusta. Applications with necessary fee must be in the hands of the secretary at least ten days prior to the date of examination. Address all communications to

CARL W. MAXFIELD, *Secretary,*
31 Central St.,
Bangor.

MISSISSIPPI STATE BOARD OF DENTAL EXAMINERS

THE Mississippi State Board of Dental Examiners will hold its next examination in Jackson beginning the third Tuesday in June 1941. Applications should be in the hands of the secretary thirty days before the date of the meeting. For further information, address

G. L. CLEMENT, *Secretary,*
Pontotoc.

NEBRASKA STATE BOARD OF DENTAL EXAMINERS

THE Nebraska State Board of Dental Examiners will hold its next regular examination at Omaha and Lincoln, June 16-21. The practical examination will be given at Creighton University Dental School, Omaha, June 16-18; the theoretical, at the State House, Lincoln, June 20-21.

HENRY A. MERCHANT, *Secretary,*
Medical Arts Bldg.,
Omaha.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations, commencing June 23 and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules for applicants, instruction sheet and preliminary application blank will be sent. Any person desiring to apply as a candidate must file the preliminary application blank, together with the examination fee of $25, on or before March 15, for the succeeding June examinations or before September 1 for the succeeding December examinations.

W. A. WILSON, *Secretary,*
148 W. State St.,
Trenton.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

THE next annual meeting of the North Carolina State Board of Dental Examiners for the examination of applicants for licensure will be held at the State Capitol, Raleigh, beginning June 23. Applications must be filed with the secretary thirty days before the examination. For application blanks and further information, address

WILBERT JACKSON, *Secretary,*
Rich Bldg.,
Clinton.

NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

THE North Dakota State Board of Dental Examiners will hold its next examination in the Gardner Hotel, Fargo, July 7-10. For information and application, address

L. I. GILBERT, *Secretary,*
401 Black Bldg.,
Fargo.

OHIO STATE DENTAL BOARD

THE next examination of the Ohio State

Dental Board will be held at the College of Dentistry, Ohio State University, Columbus, the week beginning June 23. All applications must be in the hands of the secretary at least ten days before the date of examination. For further information, apply to

MORTON H. JONES, *Secretary*,
1553½ N. Fourth St.,
Columbus.

STATE OF OKLAHOMA DENTAL BOARD

THE Board of Governors of Registered Dentists of the State of Oklahoma will hold its next examination in Oklahoma City, June 16-19. Applications for examination in dentistry, dental hygiene and dental specialties must be received by June 10. Address all communications to

W. T. LONGWELL, *Secretary*,
1st National Bank Bldg.,
Frederick.

OREGON STATE BOARD OF DENTAL EXAMINERS

THE Oregon State Board of Dental Examiners will meet in Portland, June 9-13 for the purpose of examining applicants for license to practice dentistry in the state. Applications must be filed not later than May 24. For application blanks or additional information, address

ARTHUR F. WEEKS, *Secretary*,
Selling Bldg.,
Portland.

DENTAL COUNCIL AND EXAMINING BOARD OF THE COMMONWEALTH OF PENNSYLVANIA

THE Dental Council and Examining Board of the Commonwealth of Pennsylvania will conduct examinations in Philadelphia and Pittsburgh, June 17-21. For information and application blanks, address the Department of Public Instruction, Bureau of Professional Licensing, Dental Division, Harrisburg, or

REUBEN E. V. MILLER, *Secretary*,
61 N. Third St.,
Easton.

SOUTH DAKOTA BOARD OF DENTAL EXAMINERS

THE South Dakota State Board of Dental Examiners will hold its next examination at Rapid City, June 18-21. For information and applications, address

C. H. BOYDEN, *Secretary*,
Mitchell.

TEXAS BOARD OF DENTAL EXAMINERS

THE Texas Board of Dental Examiners will hold its next examination June 16-20 in Dallas. Applications must be filed at least ten days prior to the date of examination. For further information, address

B. CARL HOLDER, *Secretary*,
Nixon Bldg.,
Corpus Christi.

VERMONT STATE BOARD OF DENTAL EXAMINERS

THE Vermont State Board of Dental Examiners will meet June 23-25 in the State House, Montpelier, to examine applicants for license to practice dentistry and dental hygiene. All applications, accompanied by examination fee, must be in the hands of the secretary at least fifteen days before the date of the meeting. For applications and other information, address

C. I. TAGGART, *Secretary*,
Burlington.

WEST VIRGINIA BOARD OF DENTAL EXAMINERS

THE West Virginia State Board of Dental Examiners will hold its next examination at the Capitol Building, Charleston, beginning the fourth Monday in June. Applications should be in the hands of the secretary thirty days before the date of the meeting. For further information, address

HENRY C. HILL, *Secretary*,
Charleston.

WISCONSIN BOARD OF DENTAL EXAMINERS

THE next meeting of the Wisconsin Board of Dental Examiners will be held at Marquette University Dental School June 16-20. Candidates having graduated prior to January 1 must have applications filed not later than May 15. Candidates who are 1941 graduates must have applications filed not later than June 1. For further information, address

S. F. DONOVAN, *Secretary*,
Tomah.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A COMPETITIVE examination to select candidates for appointment in the Dental Corps of the Navy will be held July 7 at the Naval Medical School, Washington, D. C., the Naval Training Station, Great Lakes, Ill.,

and the Naval Training Station, San Diego, Calif. A candidate for appointment in the Dental Corps must be a citizen of the United States, between 21 and 32 years of age at the time of appointment, and a graduate of a standard dental college. A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is given the title of Carnegie Dental Fellow and, according to his interest, works as a graduate student in one of the departments of the medical school. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduate Council of the university, Fellows may prepare themselves for the degree of M.S. or Ph.D. Application should be made to

GEORGE H. WHIPPLE, *Dean*,
School of Medicine and Dentistry,
University of Rochester,
Rochester, N. Y.

REFRESHER COURSES IN PERIODONTIA, SCHOOL OF DENTAL AND ORAL SURGERY, COLUMBIA UNIVERSITY, NEW YORK CITY

THE School of Dental and Oral Surgery, Columbia University, offers two refresher courses in periodontia: June 9 to 20: 1. A ten-day intensive course of lectures, discussions and clinical practice. Fee $100. January 24 to May 23: 2. An extended course, one-half day per week for two sessions, of lectures, discussions and supervised technical treatment. Fee $30 for each session.

The courses outlined in this announcement, given at the School of Dental and Oral Surgery, Columbia University, are designed to be "refresher" courses bringing practitioners abreast of modern undergraduate teaching in theory and practice in the subject.

Admission to the course is limited to qualified graduates in dentistry who are members in good standing of the American Dental Association or recognized sectional organizations. In the case of foreign applicants, membership in the applicant's national dental organization is required.

Applicants should fill in an application blank and forward it with a money order or check for the $10 reservation deposit to the assistant to the registrar, School of Dental and Oral Surgery, 630 West 168th Street, New York, N. Y.

POSTGRADUATE COURSE IN PERIODONTIA, NEW YORK UNIVERSITY COLLEGE OF DENTISTRY

NEW YORK University College of Dentistry will hold its eighth annual postgraduate course in periodontia for twenty sessions, as follows: Schedule A: Morning and afternoon sessions, June 16-27. Schedule B: Morning and afternoon sessions, June 16-18; mornings only, June 19 to July 9. All dates are inclusive. Fee $100. The course is limited to fifteen. Preference will be given in the order of receipt of application. The course will include the etiology, diagnosis and treatment of periodontal disease; various technics of pocket eradication, with conservative treatment stressed; Vincent's infection; diagnosis of types of bone resorption; mouth manifestations of systemic disease; periodontal foci of infection; toothbrushing; instrumentation; balancing of occlusion. Courses are taught by lectures and clinical work, each student treating several cases. Instruction will be given by Samuel Charles Miller, Sidney Sorrin, J. Lewis Blass and the entire periodontia faculty.

For further information and application, address the office of the dean, New York University College of Dentistry, 209 E. 23rd St., New York, N. Y.

POSTGRADUATE COURSES, COLLEGE OF DENTISTRY, OHIO STATE UNIVERSITY

THE College of Dentistry, Ohio State University, Columbus, offers postgraduate courses in dentistry that are especially designed for the general practitioner who may wish to amplify his training in any of the following fields: x-ray (course to be given June 9-13), crown and bridge (June 9-14), oral surgery (June 16-20), prosthodontia (June 16-28) and periodontia (June 23-27). The fee for these courses will be $50 a week, with the registration limited to ten men in each course. It is the aim of these courses to teach new technics as well as to review the fundamentals. For further information and application blanks, address the Dean, College of Dentistry, Ohio State University, Columbus.

RESEARCH FELLOWSHIP IN MEDICINE AND DENTISTRY BY THE GRADUATE SCHOOL OF THE UNIVERSITY OF ILLINOIS

THE Graduate School of the University of Illinois has established four research fellowships to be awarded for one year in the fields of medicine and dentistry in Chicago at a stipend of $1,200 per year (calendar year with one month's vacation). Fellows are eligible for reappointment in competition with the new applicants.

Candidates for these fellowships must have completed a training of not less than eight years beyond high school graduation. This training may have been acquired in any one of the following ways, or the equivalent thereof:

1. Work leading to the B.S. and M.D. degrees. (In some instances, the candidates would have the M.S. degree, or an additional year or two of hospital training beyond the intern year).

2. Work leading to the B.S., M.S. and D.D.S. degrees.

3. Work leading to the B.S. or B.A. degree in a four-year collegiate course and to the D.D.S. degree.

4. Work leading to the B.S., D.D.S. and M.D. degree.

Candidates should indicate the field of research in which they are interested and submit complete transcripts of their scholastic credits, together with the names of three former science teachers as references. March 1 is the deadline for acceptance of applications. Announcements of the fellowship awards will be made April 1, becoming effective September 1.

Formal application blanks can be secured from the secretary of the Committee on Graduate Work in Medicine and Dentistry, 1853 W. Polk St., Chicago, Ill.

TEMPLE UNIVERSITY SCHOOL OF DENTISTRY DENTAL ALUMNI POSTGRADUATE COURSES

THE Temple University School of Dentistry Dental Alumni Association offers limited postgraduate courses, March 12-May 14, at the School of Dentistry, Temple University Hospital and the Pennsylvania Hospital, Philadelphia, as follows:

Oral Surgery: Intensive practical course for general practitioners; class limited to twelve; fee $100.

Periodontia: Practical course for general practitioners with each student practicing the operations on a patient or patients; class limited to fifteen; fee $50.

Clinical Medicine: A series of clinics for dental practitioners by John A. Kolmer, professor of medicine in the School of Medicine and School of Dentistry of Temple University, provided there are at least twenty-five matriculants; fee $25.

Full Denture Prosthesis: A practical course for general practitioners, with each student practicing the operations on a patient and making complete denture restorations; class limited to fifteen; fee $50.

The courses are open to all members of the American Dental Association.

POSTGRADUATE COURSES AT THE UNIVERSITY OF PENNSYLVANIA

THE School of Dentistry of the University of Pennsylvania offers the following postgraduate courses:

1. Ten-day course in maxillofacial surgery, including exodontia and anesthesia, with special emphasis on care of war injuries of the face and jaws; lectures and clin-

ics on wounds, fractures of the jaws and complications such as osteomyelitis, shock, hemorrhage and wound infections; demonstrations in anatomy, roentgenologic technic and interpretation, fixation of fractures of the jaws by wiring and the use of acrylic materials for splints and prostheses, and the technic of local and general anesthesia, with surgical demonstrations at the oral surgery and exodontia clinics in the Evans Institute and Hospitals, conducted by the staffs of the dental school and of affiliated hospitals. Time: Monday, May 5, to Thursday, May 15. Fee: $100.

2. Three short courses, occupying four days, May 19 to 22:

A. Periodontia: J. Richard Walsh, East Orange, N. J.

B. Porcelain jacket crowns: Carlisle C. Bastian, New York.

C. Medicine as related to dentistry: Bernard I. Comroe and Lester W. Burket, Philadelphia.

Application should be made to the dean, School of Dentistry, University of Pennsylvania, Evans Institute, Fortieth and Spruce Sts., Philadelphia, Pa.

RESIDENCY IN DENTAL MEDICINE

THE University of Oregon Medical School Hospitals and Clinics offer a residency in the Division of Dental Medicine and Oral Surgery. Appointment will be made about the first of December. The period of service is for one year, July 1 to June 30. Compensation is $40 a month in addition to board, room and laundry. The division is under the general direction of the Department of Medicine. Its service is carried on in several units: 1. The General Outpatient Clinic. 2. The Multnomah Hospital. 3. The Doernbecher Children's Hospital. 4. The University State Tuberculosis Hospital. Service is under the direct supervision of the head of the division and a visiting staff of sixteen dentists. Application blanks will be furnished on request to

RICHARD B. DILLEHUNT, *Dean*,
University of Oregon Medical School,
Portland.

UNITED STATES PATENTS APPLICABLE OR PERTAINING TO DENTISTRY ISSUED DURING JANUARY 1941

January 7

No. 2,227,536, FRANCISCO D'AGOSTINO. Apparatus for ether anesthesia.

No. 2,227,565, ROBERT C. ANGELL. Dental equipment mechanism.

No. 2,227,566, ROBERT C. ANGELL. Warming system for syringes.

No. 2,227,735, CHARLES DALE MORTON. Lock pin for fixed dental bridgework.

No. 2,228,059, PYUNGTOO WILLIAM LEE. Method of preventing pressure strains on invested articles during molding.

No. 2,228,169, EDWARD S. KEOGH, JR. and JOSEPH M. MURPHY. Dental instrument.

January 14

No. 2,228,537, ARTHUR E. SMITH. Ampoule syringe.

No. 2,228,585, DELMER I. PLETCHER. Thrust head for syringes.

No. 2,228,679, JOSEPH C. TEDESCO. Combination toothbrush and powder holder.

No. 2,228,786, LEWIS DUANE STONER. Rotary toothbrush.

No. D-124,694, MORTON HAGUE. Design for a receptacle for false teeth and removable bridges.

January 21

No. Re.21,699, VITAL MONNIER. Phial.

No. 2,229,533, LEWIS A. WALTER and RUSSELL J. FOSBINDER. Organic compounds having anesthetic properties.

January 28

No. 2,229,664, EDNA T. MEESKE. Brush handle.

No. 2,229,739, WILLIAM E. HARRINGTON. Cartridge for hypodermic syringe.

No. 2,229,780, EUGENE J. VAILLANCOURT. Method and apparatus for mounting artificial teeth.

No. 2,229,946, GEORGE CLYDE VANALLEN. Composition for molds for metal casting.

No. 2,230,164, SIMON MYERSON. Method of making artificial teeth.

No. 2,230,171, FRANK H. VORHEES and JOHN M. BESSER. Toothbrush.